The Accompliſh'd SHIP-WRIGHT AND MARINER.

CONTAINING

The Moulding or Shaping the Body of any Ship; and to know her Burthen. With a Table of Squares and Cubes; and the Extraction of the Square and Cube Root; with their Uſe. Alſo Rules for finding the Length of the Maſts-Yards, Rigging, *&c.* How to make the Sails, proportion the Anchors and Cables. Rules to find the Prime, Epact, and Dominical Letter, fixed and moveable Feaſts, Moons Age, the time of High-Water for ever. To find the Southing, Riſing and Setting of the Moon, *&c.*

ALSO

To make the Plain-Scale, and its Uſe in Navigation; Problems of Plain and Mercator Sailing, wrought by the ſame, proved by Arithmetick; the Table of Logerithms, Signs and Tangents, How to keep a Reckoning of a Ship at Sea. The Uſe of the Fore-ſtaff, Sea-Quadrant, and Nocturnal, with the Demonſtration of the Sphere, and Problems in Aſtronomy. How to calculate an Eclipſe of the Sun and Moon; with neceſſary Obſervations on the practick part of Navigation and Sea-Gunnery.

LIKEWISE,

Tables of the Right Aſcenſion and Declination of the Sun, Semi-Diurnal Arch of the Sun, Moon and Stars. A Table of the Amplitude of the Sun from the Equator to 90 Degrees; the Longitude, Latitude, Right Aſcenſion, *&c.* of the moſt notable Stars; the Riſing, Setting, and Southing of the Pleiades; the Declination of the North Star; the time of the Riſing and Setting of 21 Stars of Note. Rules of the Ancient and Modern Aſtronomers, to judge of the Weather.

By *JOHN HARDINGHAM*, of *Great Yarmouth.*

To which is added,

A Correct Table of the Latitude and Longitude of the moſt Noteable Capes, Head-Lands and Iſlands in the World. By *JOHN THORNTON.*

LONDON, Printed for *Richard Mount* and Company on *Tower-hill.* M DCC IX.

The Dedication.

Since Your Highneſs has preſided in the Navy, *by Your Juſt and Prudent Adminiſtration, the* Antient Honour and Glory of the *Engliſh Navy* is fully Retriev'd; *Our* Enemy *daring not to look us in the Face on the* Ocean.

This Extraordinary Management of Your Royal Highneſs has Intituled you to the Prayers and good Wiſhes of all true Engliſhmen; *and amongſt the Crowd of your Adorers, I Humbly become a Supplicant, that Your Highneſs, with a Favourable Aſpect, will be pleaſed to look upon the Poor Endeavours of,*

May it pleaſe your Highneſs,

Your moſt Humble,

Moſt Obedient,

And moſt Devoted Servant,

John Hardingham.

TO

TO THE

Favourable and Candid

READER.

GEOMETRY *being the Principal Subject of this Treatiſe, attended with her* Hand-Maid Arithmetick. Geometry *demonſtrating, and* Arithmetick *proving the Truth thereof. I ſuppoſe it will find your Favourable Reception, and for me to uſe all the Rhetorick imaginable, I cannot make it ſo Splendid and Glorious to the World, as Demonſtration and Proof is capable.*

The deſign of this Tract is Principally to Inſtruct the Practical Carpenter *and* Mariner *how to Build a Ship for Burthen and Sailing; and by the Rules of Proportion to Maſt her, and fix her with Sails and Guns, and Equip her fit for the Sea, by thoſe Proportions and Rules mentioned therein; and laſt of all, by eaſie Rules and Methods, ſafely to Navigate her.*

Which I leave to ſpeak for it ſelf, knowing that Men differ in Judgment, which nothing can Regulate beyond Demonſtration and Proof; yet I ſhall not wonder

To the Moſt

Illuſtrious and High Born Prince *George*, Prince of *Denmark*, Lord High Admiral of *England*, &c.

May it Pleaſe Your Highneſs,

YOUR *exalted Poſt in this Kingdom, and particularly that of* Lord High-Admiral, *might juſtly deter ſo Mean an* Author *from Offering ſo Mean a* Preſent.

But humbly preſuming Your Highneſſes Goodneſs is not confin'd to thoſe only who bear Great Commands in the Navy, *under Your Royal Highneſſes Direction, One that has no Employment in it, humbly approaches Your Highneſs with the firſt Fruits of his Labours, deſign'd only for the Good and Benefit of thoſe employ'd in the* Royal Navy, *of which he humbly deſires Your* Acceptance *and* Patronage.

To the Reader.

wonder if I meet with some Contemners of these my Endeavours. I shall only, Courteous Reader, crave your excuse for the plainness of the Stile, which I hope will have the effect of pleasing in the general; since to please all hath been a Task so difficult, that the best of Authors have never yet performed.

I have endeavoured in as plain a method as possible I can, to be understood by the meanest Capacity, in these parts of my Labour and Study, to level at the mark so near as at last, the Industrious may come to hit the white. As this shall find Acceptance, I shall in time, according to the Encouragement I shall meet with, afford you a Tract of the like Nature in another Dress. In the mean time let this have thy Candid and Favourable Censure, and you will Oblige him that is a real Lover, and well Wisher to all that are Mathematically Inclined, by, Gentlemen,

Your Mathematical Friend,

And Lover of Arts and Honest Artists,

John Hardingham.

THE

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Advertiſement.

Writing,	*Merchants Accompts,*
Arithmetick,	*Gauging,*
Geometry,	*Gunnery,*
Trigonometry,	*Fortification,*
Navigation,	*Aſtronomy,*
Surveying,	*Dialling.*

The Uſe of the *Globes*, and other *Mathematical Inſtruments*, the Projection of the *Sphere* on any *Plan*, are Compleatly Taught by *Joſeph Stevens*, near *King David's-Fort*, in *Wapping*, *Stepney*; where Youth may be Boarded, and theſe Books Sold.

The Accompliſh'd

SHIP-WRIGHT:

OR, THE

Whole Art of Building made Eaſie.

CHAP. I.

Of Geometrical Definitions and Problems.

GEOMETRY is the Art of Meaſuring, and appears moſt Glorious, when you obſerve Aſtronomers, Geographers, Meaſurers of Land, Mariners, Ingineers, Architects, Carpenters, Painters and Carvers; in the Deſcription, Deliniation, or Meaſuring of the Stars, Countries, Lands, Engines, Seas, Buildings, Pictures, Statues and Images, uſe no other Art but Geometry; which teacheth how to Meaſure the Land, Water, Sea, Air, the whole World; and in it all Bodies, Surface, Lines, and whatſoever is to be Meaſured.

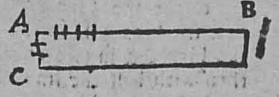
Geometrical Definitions.

A Point is void of Magnitude; is neither Quantity norpart of Quantities, yet the Terms and End of Quantity, and differs from Unicy in Number as the Point or Prick A.

A right Line is the ſhorteſt that can be drawn between two Points, hath length only, and is capable of Diviſions, as the Line A B, divided Equally at C. unequal at D.

The Ends or Bounds of a Line, are Ends and Bounds of a Finite Line, in a Circular Line, the Point, in its Motion, returns to the place where it firſt begun, ſo renders it Infinite, as in this Figure appears.

The Motion of a Point produceth a Line, the firſt kind of Magnitude: The Motion of a Line produceth a Superficies; the Second kind of Magnitude, capable of two Dimenſions, that is Length and Breadth, and may be divided as the Line A B, from A to B, and C A, from A to C, in Depth.

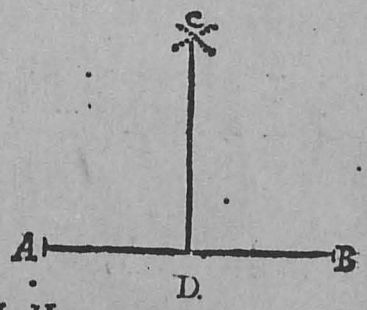


PROBLEM I.

To raiſe a Perpendicular on the middle of a Given Line.

Example. LEt A B be the Given Line, in the middle whereof, at D, it is required to raiſe a Perpendicular.

Open your Compaſſes to what Diſtance you pleaſe, greater than A D, and ſetting one Point in A, with the other deſcribe part of a Circle as at C; then with the ſame diſtance ſetting one Point in B, with the other croſs the aforeſaid Circle in the Point C: A Line drawn from the Point of Interſection at C to D, is perpendicular to the Line A B, as was required.

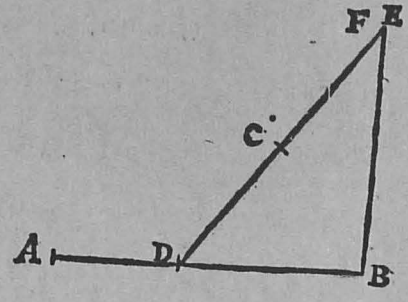


PROBLEM II.

To Erect a Perpendicular upon the end of a Given Line.

Example. LEt the Given Line be A B, on the end whereof at B, it is required to raiſe a Perpendicular.

Your Compaſſes being opened to any convenient diſtance, ſet one Point in B, and with the other over the given Line; make a Point or a Prick, as at C; then keeping your Compaſſes fix'd in C, with the ſame diſtance remove the Point at B, and croſs the Line A B in D; then draw a Line thro' D and C, and ſet off the ſame Diſtance from C to E, as from C to D; a Line drawn from this Point at E to B will be perpendicular to the Line A B required.

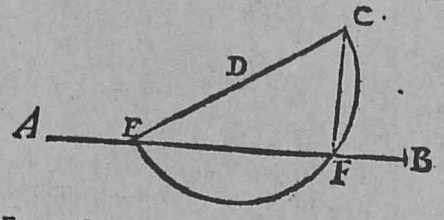


PROBLEM III.

To let fall a Perpendicular from a Point aſſigned, over the End of a Given Line.

Example. SUppoſe the Line given be A B, and the Point aſſigned over the ſaid Line be C, from whence it is required to let fall a Perpendicular.

Draw a Line at a Venture from the Point C, to cut the Line A B, as C E, which cuts the Line A B in the Point E, Divide the Line C E in two equal parts, as at D; then with half the line C E deſcribe the Arch C F E, which cuts the line A B in the Point F; a line drawn from the Point F to C, ſhall be perpendicular to the line A B, as was required.



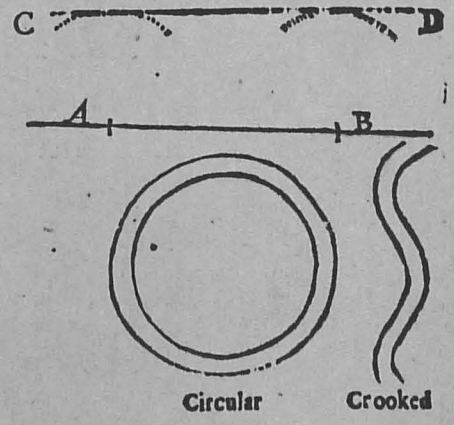
PROB. IV

PROBLEM IV.

To draw a Line Parallel to a Line Given

Example. LET the Line given (unto which a Parallel is required) be A B.

Open your Compaſſes to the diſtance you deſign your Parallel line, as from A to C, and ſweep the Arch at C with one Point in A. With the ſame diſtance ſetting one Point in B, ſweep the Arch at D; a line drawn by the back of theſe two Arches, as C D, will be Parallel to A B; a Circular Parallel is a Circle Inſcribed within a Circle on one and the ſame Center. Crooked Parallels are Croked lines, in all parts equally diſtant one from the other.

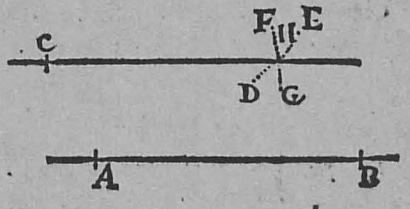


PROBLEM V.

To draw a Line Parallel to a Line Given; to paſs thro' a Point aſſigned, beyond the End of the Given Line.

Example. LET the Given line be A B, and the Point aſſigned C.

Take with your Compaſſes the Diſtance from A to C, and ſetting one Foot in B, deſcribe the Arch D E; then take with your Compaſſes the length of the line A B, and ſetting one Point in C, deſcribe the Arch F G, which Interſects the Arch D E, in the Point H; a line drawn from C through this Point of Interſection, as C H, ſhall be Parallel to the line A B required.

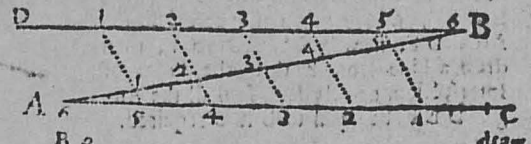


PROBLEM VI.

To Divide a Line Given into any number of equal Parts.

Example, LET the line given be A B, which is required to be divided into ſix equal parts.

From the Point B, at a venture

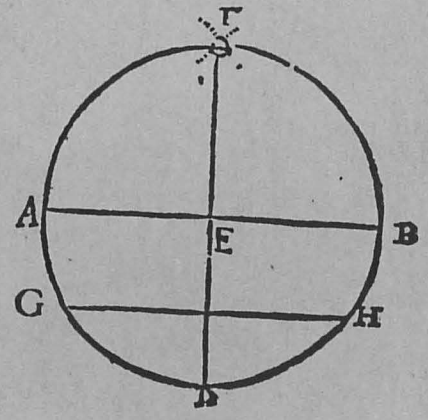


draw the Line B D, and Parallel thereunto by the Rule aforegoing, draw the line A C; then opening your Compaſſes to what diſtance you pleaſe, and ſetting one Point in A; repeat it ſix times, namely, from A to C, and with the ſame diſtance repeat it ſix times on the line B D: Parallel lines drawn from the Diviſions of B D to the Diviſions on A C, will divide the line A B into ſix equal parts required, as by this Figure appears.

PROBLEM VII.

To deſcribe a Circle on a Line Given, and Divide it into Quadrants.

Example, LET the Line Given be A B.

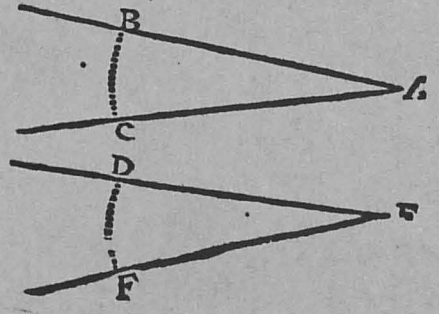


Open your Compaſſes to what diſtance you deſign the Size of your Circle, and ſweep the Circle A D B F on the Center E, the line A B divides it into two parts, which are called Semicircles; then opening your Compaſſes to what diſtance you pleaſe (greater than A E) and ſetting one Point in A, with the other Deſcribe part of an Arch; then moving your Compaſſes to *B*, with the ſame Diſtance croſs the other Arch, as at F; a line drawn from F through the Center at E, will divide the Circle into Quadrants. A *Section* or Portion of a Circle, is a Figure, contained between a right liue, and a part of the Circumference, and is greater or leſſer than a Semicirle as G D H leſſer, and G F H greater.

PROBLEM VIII.

To make an Angle Equal to an Angle Given.

Example. LET the Angle given be B A C.



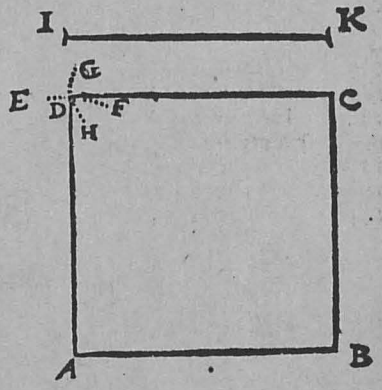
At a Venture draw the Line D E, then opening your Compaſſes to what diſtance you pleaſe, as A B, deſcribe the Arch B C with the ſame diſtance, ſetting one Point of your Compaſſes in E, with the other deſcribe the Arch D F; then take with your Compaſſes the diſtance between B and C, and lay that Diſtance off on the Arch D F, namely from D to F, then draw a Line from F thro' the Point of Interſection, namely E F, ſo ſhall the Angle D E F be equal to B A C required.

PROBLEM IX.

PROBLEM IX.

To make a Geometrical Square, whoſe Sides ſhall be equal to a Line given.

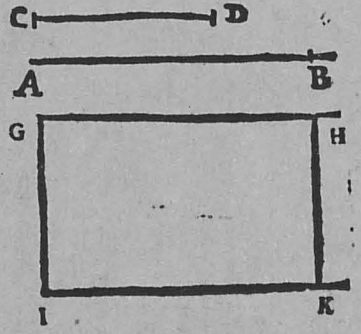
Example. LET the Line given be I K, First draw the line A B which make equal to the Line I K given; then at B (according to the Directions before given) raiſe a Perpendicular as B C, which alſo make equal to I K, then ſetting one Point of your Compaſſes in A, with the ſame diſtance I K ſweep the Arch E F, and then removing your Compaſſes to C, with the ſame diſtance deſcribe the Arch G H, which will croſs the Arch E F in the Point D; a Line drawn from the Point C and A through the Point of Interſection D, will make the ſides of the ſquare A B C D, equal to the Line I K required.



PROBLEM X.

To make a Parallelogram or Oblong, whoſe Oppoſitee Sides ſhall be equal to two Lines Given.

Example. SUppoſe the two Lines given be A B, & C D; & a Parallelogram be requir'd to be made, whoſe oppoſite ſides ſhall be equal thereunto.



The performance hereof, differs but little from the IX *Problem:* For having drawn the Line I K equal to A B given, and raiſed a perpendicular on K, and ſet thereon the line C D given, you proceed as in the IX *Problem* of the Square; taking the length of the ſide A B, and ſetting one Point in H, deſcribe an Arch at D; and then taking the length of C D, ſet one Point in I, and croſs the ſaid Arch in the Point D: A line drawn from H and I through the Point of Interſection, D makes the Parallelogram G H I K required.

By theſe aforegoing Directions may you make the Carpenters Square (which is Repreſented in the Parallelogram, by G I K) which is of great uſe in Squaring and Making of Geometrical Figures and Draughts.

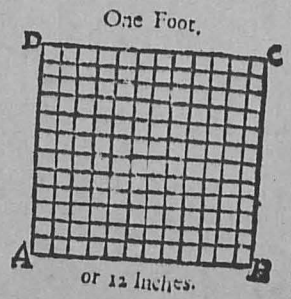
PROBLEM XI.

PROBLEM XI.

Shews the Deſcription and Content of a Square Foot, Geometrical and Arithmetically in Inches.

I here ſuppoſe our Practitioner to underſtand Arithmetick, this Treatiſe not being deſigned to Inſtruct therein.

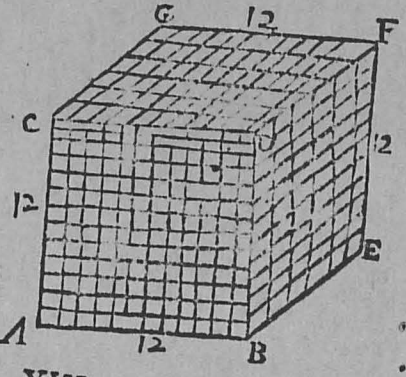
Multiply the Inches of a Foot namely 12 into it ſelf, gives the Content in Inches; as 12 times 12 which is 144, the Inches contained in a Foot, Geometrically. Let A B C D repreſent a Square Foot, divide each ſide into 12 Parts or Inches; lines drawn from the one to the other as in this Figure may be ſeen, divides the Square in 144 parts the Inches in a Foot.



PROBLEM XII.

The Deſcription of a Solid Foot of Timber, and the Content thereof in Inches.

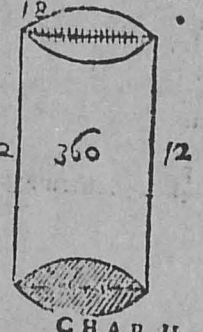
MUltiply the Inches in a Foot, namely, 12 into it ſelf, and that will give you the 144 Inches, the Content of a Superficial Foot (as in the 11th *Problem*) which multiply again by 12, will give you the Solid Content in Inches, namely 1728, as this Figure demonſtrates.



PROBLEM XIII.

The Deſcription and Content of a Right Cylinderical piece of Timber.

A Circular Plain made of equal Baſſes and Height (as this Figure) is called a Right Cylinder. The Geodety is fetch'd from the Priſma, by multiplying the Content thereof by the Height. This manner of Meaſuring anſwers the Meaſuring of a Priſma, and in all reſpects a Righangled Parallelogram; but if the Cylinder be Oblique in Baſſes, then what you deduct from one Baſe add to the other, and proceed as with a right Cylinder, and you may find the Content. A Cone is equal to $\frac{1}{3}$ of a Cylinder, being of equal Baſe and Height.



CHAP. II.

Containing Directions for Meaſuring of Timber and Board, Arithmetically.

PROBLEM I.

THE length and breadth of a piece of Timber being given in Feet and Inches, to find the Content.

Multiply the length and breadth, (being reduced into Inches if required) one by the other. The Product divided by 144 (the Inches in a Foot Square) ſhall give you the Content thereof.

Example I.

Suppoſe a Plank be 16 Foot 9 Inches long, and 2 Foot 3 Inches broad, and the Content thereof is required.

F.	I.		F.	I.		
Length 16	— 9	Breadth 2	— 3	Length in Inches 191		
12		12		Breadth in Inches 27		
31		in Inches 27		1337		
16				382		
in Inches. 191				Inches in a foot ſqare 144)	5157	(F. Pts. 35, 8 contens.
					0837	
					117, 0	
					018	

Example II.

Suppoſe a Plank or Board be 12 Foot 9 Inches $\frac{1}{2}$, or 5 Parts long, and 2 Foot 7 Inches $\frac{1}{2}$, or 5 broad, and the Content is required.

F.	In.	Pts.	F.	In.	Pts.		
Long 12	— 9	— 5	Broad 2	— 7	— 5	length in inches 153.5	
12			12			breadth in inches 31.5	
33			in inches 31.5		144)	4835.25	(33.57 Content 7675
12						515	1535
n Inches 153,5						832	4605
						1125	4835,25 *Contens in Inch.*
						117	

Example III.

Example III

Suppoſe a piece of *Board* be 16 Foot and 75 Parts long, and 2 Foot 9 broad, and the content be required.

	F.Pts.
length	16,75
breadth	2,25
	83.75
	335.°
	335
content	37.6875

Example IV.

Suppoſe a *Plank* be 20 Foot long, and 3 Foot 5 Parts in breadth, and the Content is Demanded.

20.0
35
1000
600
70,00 the Content.

PROBLEM II.

TO find the content of a *Board* or *Plank* which is Tapering, or broader at one end than the other.

Multiply the length by the breadth in the middle, the Product ſhall be the content thereof,

Example.

Suppoſe a piece of Timber be 18 Foot 9 Inches long, and 2 Foot 6 Inches broad and the content demanded

Long 18 – 9 Broad 2 – 6
12 12
35 inc. in bred. 30
18
Leng. in In. 215

Inches in length 215
Inches in breadth 30
content in inches 6450

215)6450(F. 30 Content.
0000

PROLEM III.

THE breadth of a Board or Plank being given to find how much in length will make a Foot ſquare.

Find

Find what number that is, which, Multiplied by your Breadth, ſhall produce 144 (the Content of Inches in a ſquare Foot) and that ſhall be the length required.

Example.

Suppoſe a Plank be 10 Inches Broad, and it is required how much in Length will make a Foot ſquare.

I. Pts.
10)144(14, 4 to make a Foot ſquare.
44
40

A Table ſhewing how much in Length will make a Foot ſquare, the Breadth being Given.

F. In.	F. In.	F. In. 10th.	F. In.	F. In. 10th.	F. In.	F. In 10th
F. In.		Inch. Parts.	F. In.	F. In. Parts	F. In.	F.In. Parts
Breadth Board.	0 1	12 0 00	1 0	1 0 0	2 0	0 6 0
	2	6 0 00	1 1	11 8	2 1	5 8
	3	4 0 00	1 2	10 3	2 2	5 5
	4	3 0 00	1 3	9 6	2 3	5 3
	5	2 4 08	1 4	9 0	2 4	5 1
	6	2 0 00	1 5	8 5	2 5	5 0
	7	1 8 06	1 6	8 0	2 6	4 8
	8	1 6 00	1 7	7 6	2 7	4 7
	9	1 4 06	1 8	7 2	2 8	4 5
	10	1 2 04	1 9	6 8	2 9	4 4
	11	1 1 01	1 10	6 5	2 10	4 2
	12	1 0 11	11 11	6 2	2 11	4 1
F. In.		F. In. Prts.	F. In.	F. In. Parts	F. In.	F. in. Part.

The Explanation and Uſe of the Table.

This Table is divided into ſix parts, the Firſt, Third and Fifth being the Breadth given, and the Second Fourth and Sixth contains the Inches and Parts to make a Foot ſquare required.

Example I.

Suppoſe a Plank be 10 Inches broad, and it is required how much in Length will make a Foot Square.

Look for your Breadth 10 in the firſt Column (which contains Inches) and againſt it in the ſecond Column you will find one Foot two Inches, which is the Length to make a Foot ſquare.

Example II.

Suppoſe a Board or Plank be 1 Foot, 8 Broad, and it is required how much in Length will make a Foot ſquare.

In the third Column of your Table you will find your Breadth, and right againſt it, in the fourth Column you will find 7 Inches and 2 Parts, the length to a Foot ſquare.

If you would find the Content of any Superficial ſquare, whoſe Dimenſions are taken in Yards and Feet, the Work is after the ſame nature, Multiplying the Length by the Breadth, and dividing the Product by 9, the Feet contained in a ſquare Yard.

Example. Suppoſe a Pavement be 8 Yards 2 Foot one way, and 6 Yards 2 Foot the other, and the Content required in Yards.

Y.	F.		Y.	F.
Length 8	— 2	Breadth	6	— 2
3			3	
in Feet. 26		in Feet	20	

Length 26, Breadth 20. Content in 520 Feet.

9) 520 (57,7 Content. Y. Pts.

70

70

7

If your Dimenſions be given in Yards, Feet and Inches, and the Content be required in Yard, proceed as in the ſecond Problem, reducing your Length and Breadth into Inches, Multiplying the Products one into the other, but Divide the Number produced thereby by 1296, the Inches contained in a Yard ſquare, the Quotient will be the Content in Yards; but if your Dimenſions be taken in Yards and Decimal Parts, then have you no more to do but to Multiply the Length by the Breadth, and the Product is the Content, as in *Problem* the firſt *Example* the third of Foot Meaſure.

PROBLEM IV.

Of Solid Square Timber.

SOlid Timber, both Round and Square, is commonly Meaſured by the Foot. The Content of Solid Square Timber is found by Multiplying the Length, Breadth and Depth one into the other, and Dividing the Product thereof by (1728) the Inches contained is a ſolid Foot.

Example I.

Suppoſe a piece of Timber 30 Foot 8 Inches Long, 17 Inches Broad, and 15 Inches Deep, and the Content thereof in Solid Feet demanded.

F.	I.		I.			
30	— 8	Broad.	17	Length in Inch.	368	
12		Deep.	15	Bread. & Depth	255	
Length in In. 368			85		1840	
			17		1840	
		Inches	255		736	
				Content in In.	93840	

1728) 93840 (F. Pts. 54,3 *Content*

7540

628,0

1096

Example II.

Example II.

Suppoſe a piece of Timber (whoſe Dimenſions are taken by the Foot, and 100 Parts or Decimals) be 16 Foot 50 Parts Long, 2 Foot 25 Parts Deep, and 1 Foot 26 Parts Broad, and the Solid Content thereof required.

	F. P.		
Deep	2,25	Superficial Content at the End.	2,8350
Broad	1,26		16,50 Length
	1350		1417500
	450		170100
	225		28350
Superficial Content at the End.	2,8350	Solid	46,777500 Content

Example III.

Suppoſe a piece of Timber 2 Foot 20 Parts Broad, 1 Foot 30 Parts Deep, and 25 Foot long, the Content thereof required.

Broad	220	Parts ſquare at the end	28600
Deep	130	by the length in Parts	2500
	6600		14300000
	220		57200
Pts. ſquare at the end	28600	the Solid Content	71,500000

There is a Cuſtomary way of Meaſuring this ſort of Timber, by adding the Breadth and Depth together, and taking the half thereof for the Square at the end, and that Multiplied by the Length, for the Content which is Erronious, and makes the Piece greater than it is, as by this laſt Example may be proved, where the Content is found to be 71. 5 Foot, which by this way of Working will Amount to be 76. 5.

PROBLEM V.

OF Tapering Timber, or Timber bigger at one end than the other, into which Form Trees are generally Hew'd. The uſual way is to take the Depth and Breadth in the middle, which Multiplied together, and the Product by the Length for the Content which way is Erronious, making the Content leſs than in reality it is.

The true way is to find the Content at both Ends, and Multiply the one by the other, out of which Extract the Square Root, add this Root and the Contents of both the ends together, Multiply the ſame by $\frac{1}{3}$ of the Length, the Product is the Content thereof.

Example I.

Suppoſe a piece of Timber, whoſe greateſt end is 1 Foot 75 Parts Broad, and 1 Foot 32 Parts Deep, and at the leſſer end 1 Foot 22 Parts Broad, and 91 Parts Deep, the Length of the Piece 12 Foot, and the Content thereof in Solid Feet demanded.

Breadth of the greateſt end. 1,75 Parts.
Depth at the greateſt end. 1,32 Parts.

350
525
175

Content at the greater end 2,310
Content at the leſſer end 1,11

231
231
231

Product by Multiplication of the two Ends. 2,5641

Breadth at the leſſer end. 1,22
Depth at the leſſer end. ,91

122
1098

Cont. at the leſſer end 1,1102

Product by Multiplication of the two Ends. 2,5641 (1,60 Root
1
26) 156
320) 0041

Square Root 1,60
Content of the great end 2.31
Content leſſer end 1.11

Sum 5.02
Multiplied by 4 the ⅓ of the pieces length.

20,08

By which the Content is found to be 20 Foot 08 Parts required.

Example II.

Suppoſe a piece of Tapering Timber be one Foot ſquare at one end, and 5 Parts Square at the other, and the Content thereof is demanded in Solid Feet.

F.P.
Great end. 1,0
1.0

Great end. 1,00 Content
Small end. ,25

500
200

Product by Multiplication. ,2500

Small end 5 parts:
5

Content 25 ſmall end.

Product by Multiplication 2500 (Root 50
100) 000

ſquare Root ,50
Great end *Content* 1,00
Small end *Con.* ,25

1,75
⅓ of the length 10,

the Content in Feet 17,50 requir'd

PROBLEM VI.

THE Breadth and Depth of a piece of Timber being given, to find how much in Length will make a Foot ſquare, or ſolid.

Multiply

Multiply the Breadth by the Depth, and Divide 1728, by the Product, the Quotient is the Length required.

Example.

Suppoſe a piece of Timber be 9 Inches Broad, and 7 Inches deep, and it is required how much in Length will make a Solid Foot.

Breadth 9 Inches
Depth 7 Inches

Content of 63 the end

63) 1728 (27 Inches in Length to make a Solid Foot.
468

27

A Table ſhewing how much in Length will make a ſolid Foot of ſquare Timber; the ends being Geometrical Square, and known in F. and Inches

Side of a Square.	F.	In.	Length.	Side of a Square.	F.	In.	Length.	Side of a Square.	F.	In.	Length.	Side of a Square.	F.	In.	Length.
0	0				1	0	10 0		2	0	0 3 0				
1	0	2	0 0		1	1	10 8		2	1	2 8				
2	0	6	3 0		1	2	8 6		2	2	2 6				
3	0	7	0 5		1	3	7 6		2	3	2 3				
4	0	6	0 0		1	4	6 7		2	4	2 2				
5	0	5	5 0		1	5	5 9		2	5	2 1				
6	0	4	0 0		1	6	5 3		2	6	1 9				
7	0	2	11 2		1	7	4 8		2	7	1 8				
8	0	2	3 0		1	8	4 3		2	8	1 7				
9	0	1	9 3		1	9	3 9		2	9	1 6				
10	0	1	3 3		1	10	3 5		2	10	1 5				
11	0	1	2 3		1	11	3 3		2	11	1 4				
12	1	0	0 0		2	00	3 0		3	F. 0	1 3				

This Table needs no Explanation, it being of the ſame kind as the Table for Superficial Meaſure, and is uſed after the ſame Nature; for having the ſide of the ſquare given, enter the Table (and in the Column ſo Marked) look for the ſide of your ſquare, and in the next Column on the Right hand you have the length for a ſolid foot; if your ſq. be 11 Inches, the length will be found to be 1 foot 2 Inches and 3 Parts.

2*d*. If the ſide of your ſquare be 2 F. 2 In. the length will be found to be 2 Inc. and 6 Parts to make a Solid Foot.

PROBLEM VII.

The Meaſuring of Round Timber.

BEfore you can proceed to Meaſure Round Timber, you muſt know how, by having the Diameter of a Circle to find the Circumference, as alſo the Area or Superficial Content thereof.

The Proportion (the Diameter being given to find the Circumference) is as 7 is to 22, ſo is the Diameter to the Circumference, or as 22 is to 7, ſo is the Circumference to the Diameter.

The Proportion to find the Area or Superficial Content of a Circle, is as 28 is to 22, ſo is the ſquare of the Diameter to the Superficial Content; or as 88 is to the ſquare of Circumference, ſo is 7 to the Content.

Example

Example.

The Diametor given 10, to find the Circumference.

as 7 is to 22, ſo is 10 to 31,4

```
        10
       ---
 7 ) 220 ( 31,4 Circumf.
       10
      ---
       30
      ---
        2
```

Example.

The Circumference being given 31,4 and the Diameter Required.

```
                          F. Pts.
As 22 is to 7, ſo is 31,4 to 9 99.
                7
               ---
22 ) 2198 ( 9,99 Diameter.
      218
     ---
      200
     ---
       02
```

A Table ſhewing, by the Girt or Circumference of any given Tree, what Length in Inches will make a ſolid Foot.

The Compaſs of the Tree in Inches.	The Length of a ſolid Foot in Inches and Tenths. I.	P.	The Compaſs of the Tree in Inches.	The Length of a ſolid Foot in Inches and Tenths. I.	P.	The Compaſs of the Tree in Inches.	The Length of a ſolid Foot in Inches and Tenths. I.	P.
12	150	8	42	12	3	72	4	2
13	128	5	43	11	7	73	4	1
14	110	8	44	11	1	74	3	9
15	94	8	45	10	7	75	3	8
16	84	3	46	10	2	76	3	7
17	75	1	47	9	8	77	3	6
18	67	0	48	9	4	78	3	6
19	60	1	49	8	9	79	3	5
20	54	3	50	8	5	80	3	4
21	49	2	51	8	1	81	3	3
22	48	9	52	7	8	82	3	2
23	45	9	53	7	4	83	3	2
24	34	9	54	7	1	84	3	1
25	34	7	55	6	9	85	3	0
26	32	7	56	6	6	86	2	10
27	29	7	57	6	3	87	2	9
28	27	7	58	6	0	88	2	8
29	25	8	59	5	7	89	2	7
30	23	8	60	5	5	90	2	7
31	22	9	61	5	2	91	2	6
32	21	2	62	5	0	92	2	6
33	19	2	63	4	9	93	2	5
34	18	3	64	4	7	94	2	4
35	17	4	65	4	5	95	2	4
36	16	5	66	4	4	96	2	3
37	15	7	67	4	2	97	2	3
38	15	8	68	4	1	98	2	2
39	14	9	69	4	0	99	2	2
40	13	11	70	3	10	100	2	2
41	12	5	71	3	9			

The Uſe of this Table.

This Table in Uſe differs nothing from the foregoing Table of ſolid and ſuperficial Meaſure; for having found in the Table the Girt of your Tree, in the Column next on the Right hand, and in the ſame Line, you have the length required.

Example.

Suppoſe a Tree be in the Girt 57 Inches, and its length demanded to make a ſolid Foot; look in your Table, and in your third Column you will find 57, and right againſt it in the fourth Column you will find 6 Inches, 7 Parts, and ſo much in length at the aforeſaid Girt, ſhall make a ſolid foot required.

How

How to find what Length at any Girt given, will make a ſolid Foot by Arithmetick.

Example.

Suppoſe a Tree, 12 Inches in the Girt or Circumference, and it is required how much in length will make a ſolid Foor.

By your Directions and Rule before given, find the Area or Content of the Circle at the Girt. Thus

```
Girt  12                as 88 to 144, ſo is 7 to 11,45
      12                          7
     ---                        ---
      24                 88 ) 1008 ( 11.45
      12                      --
     ---                      128
Square of the Girt 144        ---
     ---                      400
                              ---
11,45 ) 1728,00 ( I. P.       480
        ------  150,9 the     ---
          5830  len. for a     40
                solid foot.---
         10500
         ---
           195
```

Then for as much as there are 172800 100 Parts in a ſolid Foot, find what Number that is, which, Multiply'd by 1145 100 Parts, ſhall produce 172800 thus.

A Round piece of Timber, the Girt thereof being given 7 Foot 85 Parts, and the Length 15 Foor, the Solid Feet therein contained are required, firſt by the Directions before given find the Area of the Girt. Thus,

```
Girt  7.85          as 88 is to 6162, ſo is 7 to the Content of the Girt 4.90
      7.85                        7
     ---                        ---
      3925               88 ) 43134 ( 4.90 Girt Area.
      6280                    ---     15 Length of the Piece.
     ----                     793     ---
      5495                    °14     2450
     ---                      ---     490
Square Girt 61.6225                  ---
     ---                             73,50 Content of the Piece.
```

PROBLEM VIII.

Of Round Tapering Timber.

The Rule is Multiply the Content of the Girt at each end, one by the other, out of which Extract the Square Root, then to the ſquare Root add the Content of the Girt at each end; the Sum of theſe Three, added together and Multiplyed by $\frac{1}{3}$ of the Length ſhall be the Content.

Example

Example.

Suppoſe a piece of Round Tapering Timber be at one end 7 Foot 85 Parts in Girt, and at the other end 5 Foot 35, and the length of the Piece 18 Foot, the Solid Feet therein contained are deſired.

for the Content of the great end Girt

Girt great end. 7,85
7,85

3925
6280
5495

F.P.
as 88 is to 7, ſo is 61.6225 to 4.90
7

88)43135 | 75(4,90 Content of the great end Girt.
793
015

for the Content of the ſmall end Girt.

Girt 5,35
5,35

2675
1605
2675

F.P.
as 88 is to 7, ſo is 28,6225 to 2.27.
7

88)20035 | 75(2.27 *Content of the leſſend*
243
675
59

Content great end 4,90
Content ſmall end 2,27

Content great end 4.90
Content ſmall end 2.27
Square Root. 3,33
Sum 1050
Multiplied by ⅓ the Length 6
The Content. 63,00 Foot

3430
980
980

11.1230(3.33 Square Root.
9

63)212
189

663)2330
1989(
331

Example.

Suppoſe the Diameter of a Circle be given two foot, 50 parts, and the Superficial Content thereof required.

250
250

12500
500

Square of the 6,2500 Diameter

as 28 is to 22, ſo is 625 Diameter ſq. to 4,91

22

28)13750(4,91 Requi.
255
030

1250
1250

13750

F

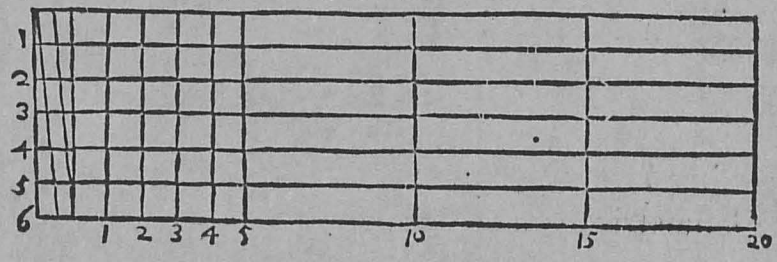
If the Circumference be given to find the Superficial Content. The Proportion is as 88 is to 7, ſo is the ſquare of the Circumference to the Superficial Content thereof.

The Deſcription and Make of a Diagonal Scale of Feet and Inches.

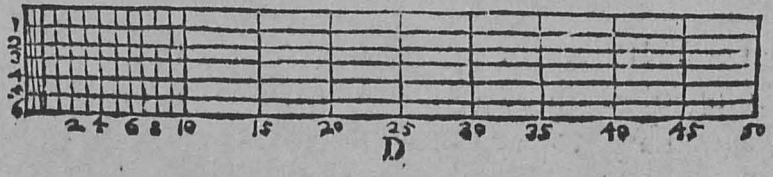
THE Diagonal Scale is no other than a Scale of equal parts, by Diagonal Lines, dividing the greater parts into leſſer, as may be ſeen in the Figures underneath, where each ſmall Diviſion repreſents a Foot, which Foot, by the Diagonal Lines, in the firſt Diviſion, at the end on the Left Hand, is Divided into Inches by Diagonal Lines, drawn from Corner to Corner, and the help of ſix equal Parallels. Theſe Scales are very uſeful in Delineating or Demonſtrating any Draught or Model, whoſe Dimenſions are given: They may be of what Largeneſs you pleaſe, according to the Size you deſign your Draught, the larger the better, and the ſmaller the Error. Theſe two Scales hereunder are of a good Size, the ſmall one of 50 foot, for Modelling of Ships, and the large one for a ſweep of Moulds. They are made after this manner: Having made the ſquare Figure A B C D, according to the length you deſign, and of what Breadth you pleaſe, and divide the Length into as many equal parts as you deſign, which in this Figure is 50, the firſt 10 being divided into ſingle Feet, the other part into Tens or Fives is ſufficient. Then divide your Breadth into ſix parts, and draw Parallel Lines as you ſee in the Figure. Then divide your firſt Foot towards the Left Hand into two equal parts, and draw a Line from thence to the Corners, divides the Foot Diagonally into ſingle Inches, as may more plainly be ſeen by the Figure, than expreſs'd by Words.

Note, Each particular Figure in the Precedent Operations hath a ſeveral Scale belonging to it, which is not common to any Work of this Nature.

A Scale of Feet.



A Scale of Feet.



D

The

THE

ACCOMPLISH'D SHIP-WRIGHT.

CHAP. III.

Shewing,

How to Draw the Middle of a Ship. To ſweep a Rend of Moulds, either for Sailing or Burthen. The Deſcription of the Riſing of the Floor, Afteron and Forward. As alſo the narrowing of the Floor and Dead Riſing, with the narrowing of the Deck, and Height of Breadth Demonſtrated.

Likewiſe,

Shewing how to find the Exact Burthen of a Ship Geometrically and Arithmetically.

As Alſo,

General Rules for the Maſting, Yarding and Rigging of a Ship, *&c.* With many other things Neceſſary to be known.

To draw a Draught of the Body of a Ship, according to Dimenſions Given on Paper or Parchment.

Example. SUppoſe a Ship be 65 Foot on the Keel, and here Rake forward 15 Foot, 6 Foot thereof at one Foot raiſe, the other part with a fair ſweep forward to 14 Foot Height from the bottom of the Keel, breadth 21 ½ foot at ⅓ of the Length of the Keel forward. Let your Stem keep a fair ſweep to its Height 14 foot, to lay the Boltſprit on. Let her Depth be ten foot, from Plank to Plank, in the Hold in the Midſhips, her Rake After on 2 ½ foot, Stern Poſt 2 foot, falſe Stern Poſt one foot, let her be 4 foot between Decks, and 4 foot 10 inches After on, with 3 foot 9 inches Forward, and the Deck Riſing 18 Inches Aft from Midſhips, and 6 inches Forward; Dead riſing at 10 foot After on, and 9 foot 6 inches in the Midſhips, Waſte 34 inches the Draught according to theſe Dimenſions is required.

Having conſidered the largeneſs of your Model, with the ſize of your Paper or Parchment, and according thereunto made your Scale, proceed as in this figure in manner following,

Firſt, Draw a Line as A B, and ſet off 12 Inches at the Stern, 15 Inches in the Midſhips, and 18 Inches Forward, and draw a Line thro' theſe three Points, and this ſhall demonſtrate the Keel. Then on the Aft part thereof at A ſet off one foot for your falſe Stern-Poſt, and from thence two foot for your Stern-Poſt (for the Keel reaches to the back of the falſe Stern-Poſt) Then ſet off 2 ½ foot the Rake Abaft, and there raiſe a perpendicular, ſetting thereon 17 foot, which will give

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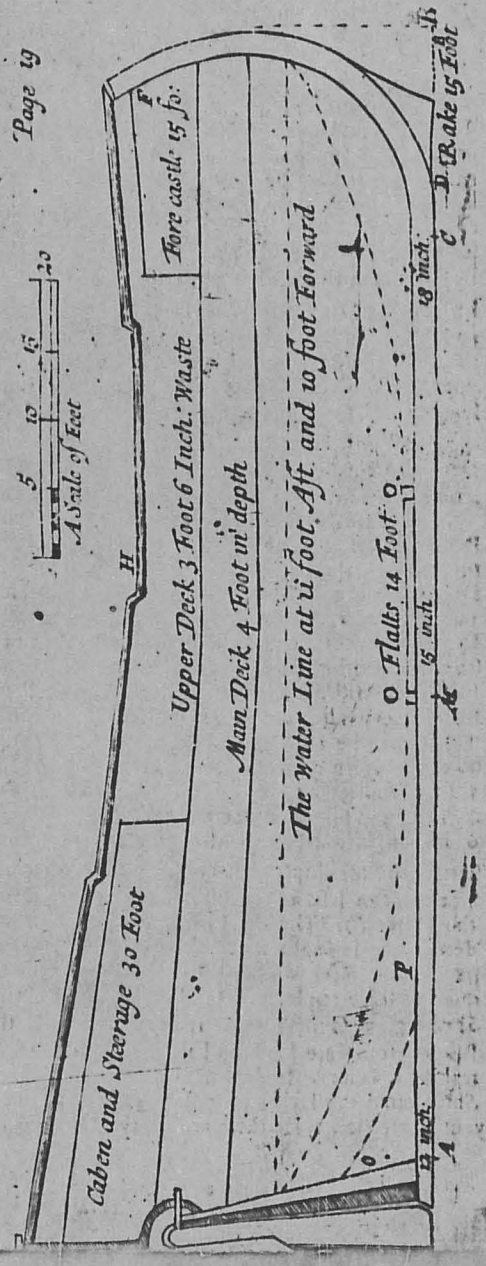


youthe Extent of the Stern-Poſt After on. From this Prick draw a Line to the After part of the falſe Stern-Poſt, and the After part of the Stern Poſt, which will deſcribe the falſe Stern Poſt, and on a ſquare from the Height of 17 foot, ſet off 8 inches or more if you pleaſe, and draw a Line from hence to your two foot Prick on the Keel for your Stern Poſt. From the fore part of the Stern Poſt ſet off 65 foot for the length of the Keel from A to C. Then from C ſet off 15 foot for the Rake forward to E, and there raiſe a perpendicular which bounds the utmoſt Extent of the Ship forward. Then from the fore part of the Keel at C ſet off 6 foot to D, and on a perpendicular Line at D ſet off one foot for the Raiſe, and ſweep an Arch from C thro' this Point; this differs but little from the Keel, but it trends upwards, and helps then ſweep of the Stem, and thereby gain more hold in the Water forwards, and helps owards keeping a Wind. Upon your perpendicular line at E, ſet off 14 foot, and then ſweep an Arch from the Extent of your ſix foot thro' this Point, as alſo another Arch within it, Parallel thereto, and that will deſcribe the Stem as you may ſee in this Model.

Then from the bottom of the Keel ſet off in the Midſhips 12 $1\frac{3}{12}$ Foot, which will be 10 Foot from Plank to Plank within, 2 Foot $1\frac{3}{12}$ being Deducted for the Keel, and the Timber lying thereon. Let your Deck riſe Aft 18 Inches, and forward, thro' 6 theſe three Points draw a Line from Stem to Stern, which repreſent your Main Deck. Place your Tranſome 20 Inches above the ſaid Deck, which will lye at $15\frac{5}{12}$ foot. The Stern Poſt from the bottom of the Keel 17 $1\frac{3}{12}$, falſe Stern Poſt one foot. Then ſet off 4 foot from your Main Deck in the Midſhips (for the upper Deck) Aft 4 foot $\frac{10}{12}$, and forward at the Stem 3 $\frac{10}{12}$ draw a Line thro' theſe three Points from Stem to Stern, and that will Deſcribe the upper Deck.

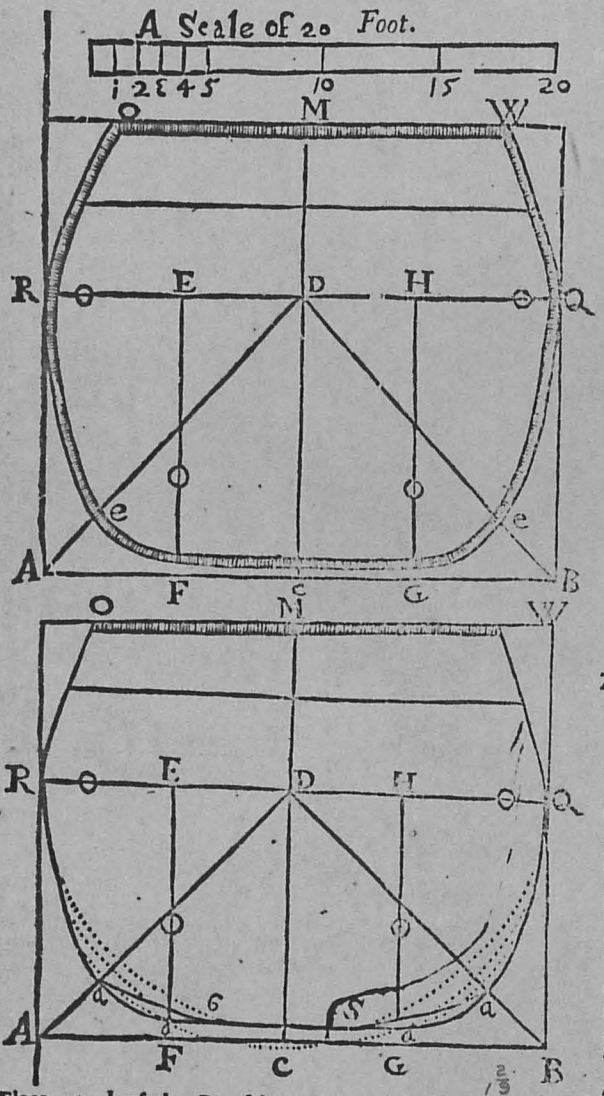
Then take 3 foot 4 inches, and ſet off for the Depth of your ſide from the Upper Deck upward, and that will be the Depth of your Waſte, and top of your Gunwald ſignified by the Letter H. Then ſet off 8 Inches in the ſide more upward for your Drift. At the Main Maſt Aft, raiſing your ſide Aft, to lead with your Work 18 or 16 or 14 foot, as you pleaſe, at the end thereof let your next Drift be of the like Depth, 8 inches; and ſo ſuffer your Work to lead Aft, anſwering to your ſide. And from the Midſhips forward, your Waſte riſing forward to 2 or 3 inches, 20 or 23 foot, your fore Driſt will be 8 Inches from the top of the ſide; at the top of this Driſt let your ſide lead forward with your outſide Work, and Depth of the laying of the Forecaſtle, which may be 14 Inches or 16 inches at the fore part; and the Quarter Deck After on at the Stern 30 inches in Depth. The Steerage and Cabbin 30 foot in length, and 5 foot and 9 aft in Depth, or Depth at the Bulk Head or Fore part, 5 Foot 4 Inches. The Fore-Caſtle 15 Foot in length, 5 Foot deep, at Bulk Head 5 foot 6 inches forward near the Stem. —— The Dead riſing on the Flour Timbers in the Midſhips, to have 7 inches or 6 inches dead riſing $\frac{1}{2}$ inch dead riſing to a foot more or leſs, as you pleaſe. And her dead riſing forward 9 foot, beginning from the Letter ⊙. The dead riſing, beginning from the Letter ⊙ to 10 foot Aft. This dead riſing is ſwept with an Arch of a Quadrant on a perpendicular, let fall from the part of the Keel, where the Timber Mark'd ⊙ beginneth either Forward or Aft, as is more at large explained in the following Figures. The Head, or (as ſome call it) the Shearing, or Cull Water. Its proportion for the length thereof is $\frac{1}{4}$ the length of the Beam; ſome are for only half the Breadth of the Beam, for the Length, which is for making a Comely Head, which is by rounding your Shearing, and Railes well. In all Ships mind the laying your Head as high as you can, gaining what Height you can for your Horſe Holles, for there are many Convenience that Altereth it. *To*

To Sweep a Bend of Moulds, according as you deſign your Ship, either for Sailing or Burthen.

DRaw the Line A B in the middle whereof at C, raiſe a Perpendicular at the Line C M, then ſet of the half Bread (which is ſuppoſed as by the former Model to be 21 foot $\frac{1}{2}$) on each ſide thereof as at A and B, then draw the Line B Q and A R, ſo have you the extream breadth of your Ship, which let be at 12 foot height rom the Keels bottom, as from C to D, and draw the Line R Q Parallel to A B, then et off on each ſide C D 5 foot, and draw the Lines E F and H G parallel to D C, then draw your dead riſing (which let be 6 7 or 8 Inches as you pleaſe) from F to G, then draw Diagonal Lines from D to A and B, and divide thoſe Diagonals D A and D B, into 9 equal parts, and thro' the ſecond diviſion from A and B ſweep the two Arches F e and G e, finding their Centers (by tryal) on the Lines E F and H G which be at O O, theſe 2 Arches are 4 foot each, then upon the Line R Q find (by trial) a point that ſhall ſweep the Arch e R and e Q which will be at O O, near R and Q let this Arch be extended above the extream breadth according to the depth of your Ship, 3 or 4 foot the length of this Arch is 11 foot 2 inches, then ſet of your Tumbling Home (which let be 2 foot) from T to W and from T to O, at the Main Maſt as long as the Ship will hold it, and where ſhe narrows in breadth, ſhe muſt narrow in the waſte or Walls fore and aft. Theſe Directions will help you to draw any Frame you deſire, (keeping your proportion and Rule) neither flat or Circular, if proportioned by Elipſes from all parts of the Bottom. That there ſhall be no Hollows in any part of the Body, which will anſwer your deſired end, either for Sailing or Burthen, or to carry Sail at Sea, without Baſaſt, conſequently to go to *Newcaſtle*, which may be effected.

The

The Deſcription of the Frame.



THis Frame is drawn at 11 foot deepth in the Hold, from Plank to Plank in the Midſhips, which is 12 foot 6 inches to the bottom of the *Keel*, and hath 4 foot depth between decks from Plank to Plank, with 3 foot 8 inches Depth in the Waſte. The narrowing of the ſide from the main Breadth is 2 foot at the top of the Gunwald.

This is a deep Frame, and is deſigned for Burthen; for here the height of Breadth being raiſed high, and the Floor continued Forward and Aſt, ſo far as that you muſt begin your dead riſing to have a quick way to the Rudder, that your Ship may be governed by her Helm.

The deſcription of the Frame

THis Frame is 11 foot from the Keel, the Arch prick'd to the bottom of the Keel is a Cemicircle, demonſtrating a Frame by the Eliptick Prick within it, from a Floor one third of the Breadth, drawn from 55 to R and Q, the other Prick'd Line below or underneath the Pricked Cemicircle is an Elipſis from the greater Floor. The piece of the black Arch, drawn from the Floor, at $\frac{1}{3}$ of the Breadth of the Frame to the $\frac{2}{9}$ of the Tangent Line ſheweth another ſort of Frame. So that in this Figure you may ſee the different ſorts of Shapes of

of theſe Moulds, which have their Effects when well ended, either for Sailing, Burthen or Stiffneſs. Stiffneſs being a good Property in any Ship. Was I to enlarge on this Subject it would be a Volume of it ſelf. The lower ſweep is a Floor of 10 Foot, drawn to $\frac{2}{19}$ part of the Tangent or Diagonal Line, marked A A and A ſwept with an Arch from A A to R, and A A to Q, and is the largeſt of theſe Frames.

The Deſcription of the Riſing of the Floor, After and Forward.

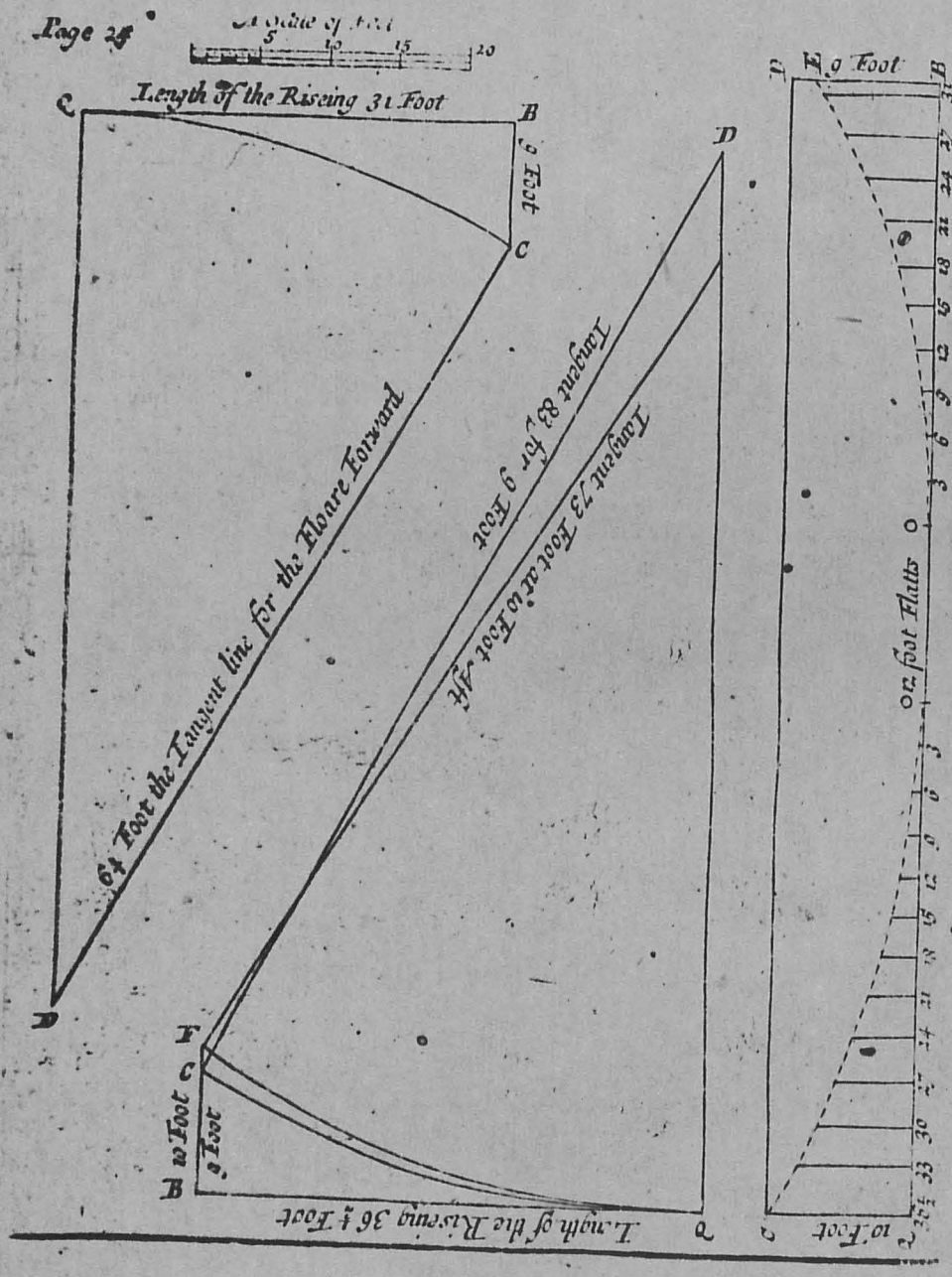
FRom the middle of the Keel, or on that part thereon you deſign to begin your riſing Line aft, to the height of the water Line, on the Stern-Poſt, which is the Line B. E. ſwept by a Circle, being a Semediametrical Arch, extended on a Perpendicular, raiſed at the Point, where you begin your dead riſing, which you ought to be exact in, for if the Point of your Compaſſes be on one ſide it makes your Arch fuller or narrower according as your Arch is ſwept at the beginning, or end of the Sweep, ſo you muſt beſure your Compaſſes reſt on the Perpendicular Line, the ſame thing is required in the work, for the narrowing of the Floor, the hanging of the Rails, or all other Circular Lines what ſoever; this work performed by the Table of Squares, exactly findeth the Tangent of the Circles of every ſuch riſing, or narrowing of the Floor, breadth or narrowing of any part of the Ship, and is of great uſe for the ſetting your Bows, to ſee if they hang by a true Sweep or no.

The Demonſtration.

DRaw the Line D. Q. at Q. erect a Perpendicular, and ſet thereon 31 foot to the Point *B*, for your dead riſing length, on *B.* let fall a Perpendicular, or draw a Parallel Line to the Line Q D, and ſet thereon 9 foot from the Point B to C for your dead riſing, then from the Point Q. with one foot of your Compaſſes on the Line O Q draw an Arch from the Point Q to C the diſtance found D to C is from the length of the Tangent Line that ſweepeth that Arch, which Arch deſcribes the dead riſing Forward, Figure 2d and 3d is after the ſame manner.

The Demonſtration of Figure I.

DRaw a ſtrait Line as the Line Q B and ſet thereon the length of your Ship, at 20 foot Draught of Water after on and 9 foot forward on the extream length, being 84 foot the dead riſing begins 33 foot afaſt the Stem, the Flats continuing 22 foot, and the dead riſing 39 foot to the extream length aft, now at the Point Q aft, ſet off 10 foot towards the Point C. on the Line Q. this is called the dead riſing after on, and 9 foot ſet on the Line B. D. that is, the dead riſing forward, the length of the riſing forward is 33 foot in the Frame, beginning at the Point ⊙ and ends in B. a line drawn from this Point ⊙ to the Point E. on the Line B. D. is the Arch of the riſing Line forward, and the Arch from the Point ⊙ aft to the Point C. is the riſing Line after on, at your Flats ſet off 6 Inches dead riſing for your floor, where your dead riſing begins. Then divide the ſpace of 33 foot forward, by 3 foot, or by your placing your Timbers, and the Arch ſwept ſheweth the riſing of every Timber at 3 foot diſtance forward, and is the ſame aft. In the figure of the dead riſing aft the Tangent Line is 83 foot, that ſweepeth the Arch for 10 foot dead riſing and 73 foot that ſweepeth the Arch for the dead riſing at 9 foot, ſheweth the difference how much the way is made quicker by one foot, if you deſign for Burthen you may have more Flats, if for Sailing, let there be but one flat in your Ship



The Deſcription of the Narrowing of the Floor, and Dead Riſing annexed.

Example. SUppoſe a Ship to be 79 foot 6 inches, at the extream length, and 19 foot in breadth, at the floor Timber Heads, where the dead riſing take its beginning forward and afteron; beginning 31 foot from the extream length forward, and 36 foot and 6 inches from the extream length aft towards the Midſhips.

The Demonſtration of the Narrowing of the Floor.

DRaw the Line Q B and from your Scale of Feet, ſet thereon 79 Foot 6 Inches, then from your Scale ſet on the ſaid Line Q B from B to F 31 Foot, at F where your dead riſing beginneth forward, then from Q to E ſet off from your Scale of Feet 36 Foot 6 Inches in E, where your dead riſing beginneth afteron, then erect a Perpendicular at Q, alſo another at B, and take one half the breadth of the Floor, which is 5 Foot, take this 5 Foot from your Scale of Feet, & ſet it on this perpendicular, at C from B, ſo the Line B C ſhall be the extream narrowing of the Floor forward, and 5 Foot placed on the Line Q G afteron, ſhall be the narrowing of the Floor aft; then from F to E is 12 Foot, the Timbers placed there are reckoned Flats, and have one half inch dead riſing to a Foot of Floor, but here is allowed 6 Inches to a 10 Foot Floor, then from the Point F forward ſweep an Arch from F to C, and that Arch ſhall be the Arch of the narrowing of the Floor forward. The Tangent that ſweep this Arch is 99 foot, as in the figure 3 is ſpecified, which inſtructs you how to find it, then the ſpace Frame F to B divide by one Foot, from off your Scale, which is 31 equal feet, and draw them parallel to B C, and where theſe Lines touch the back of the Arch ſwept from F to C, ſhall be the narrowing of the floor required.

As for Example, The 8th Timber forwards from F (Timber and Rombe) may be 15 foot forward from F, take your Compaſſes and ſet one Foot in F with an Extent of 15 Foot from off your Scale, and where the other reſted at 15 foot on the Line F B, meaſure the diſtance to the back of the Arch; and on your Scale of feet it will be found to be 1 foot 2 inches, ſo much the Floor will be narrower in that part of the Ship forward, than it is where the Dead riſing begin Forward.

The Deſcription of the Dead Riſing.

Example. DRaw the Line G H equal to the Line Q B (the narrowing of the floor and Dead Riſing being always of Equal Length, but differ in Height and Breadth of the floor) the Dead Riſing Forward is 9 Foot, and After on 10 Foot.

Take 9 from your Scale and ſet it off from H to L, and ten Foot taken off your Scale, and ſet off from G to I, gives the dead riſing afteron, then ſet 10 Foot off from H to K, and draw the Line I K, which is the Line of the extream length of the dead riſing, then draw Parallel Lines from the narrowing of the Floor, from the Line G H, to the back of the Arch. In this Figure of the dead riſing, and the diſtance between the Line G H and the back of the Arch, will be the dead riſing for every Foot or Timber placed in the Ship, and is double the narrowing of the Floor, when the dead riſing is equal to the breadth of the Floor of the Ship.

Example.

TWenty Foot Aft from the beginning of the dead riſing from E, meaſured by the Scale, is 3 Foot 8 Inches, the narrowing of the Floor being 1 Foot 10 Inches, the

Tangent that ſweepeth this Arch of the Dead Riſing, afteron is 71 Foot, deſcribed by the Figure 2. The Deſcription thereof is taught in Chapter the Second.

The Deſcription of the narrowing of the Deck, (or height of Breadth Demonſtrated.)

Example 1. A Ship or Veſſel 79 Foot from the inſide of the Stem to the inſide of the Stern-Poſt, at the height of breadth, or on the lower Deck, or Gun-Deck, and 21 Foot 6 Inches in breadth, keeping near breadth 12 Foot in the Mid-ſhips, and narroweth to 14 Foot, at 7 Foot from the Stem, within on the Deck forward, and afteron to 12 Foot breadth, at 7 Foot of the Stern Poſt.

The Demonſtration.

DRaw the Line A *B* Figure 4, and ſet thereon 79 Foot, then erect a Perpendicular at A, and another at B, and draw the Line A D and B C, then take off 21 Foot 6 Inches from your *Scale*, and ſet it on the line A D from A to D, and from B to C, then draw a Line from D to C, then A B C D will be an Oblong *Square* to contain your Work.

Example. THE extream breadth here in this Figure is 26 Foot 6 Inches, and is diſtant from the *Stern*-Poſt 36 Foot 6 Inches, and continues ſo forwards 12 Foot, with 31 Foot from the *Stem*, from hence they take the Narrowing forward and aft.

The Demonſtration.

TAke from your *Scale* of Feet 36 Foot and 6 Inches, and ſet it off from A to K on the Line A B, as likewiſe from D to I, on the Line D C, and draw a Line from I to K, which will be 21 Foot and 6 Inches, the extream breadth of your *Ship* from outſide to outſide, then ſet off from K to H 12 Foot, and from I to G the ſame, and draw a Line from G to H, which ſhews the extream breadth continued, then divide your Oblong *Square* into 2 equal parts, as B C in F, and A D in E, and draw the prick'd Line *F E*, which Line is the middle of the *Ship* or Figure, then from the *Stem* ſet off 7 Foot, as in the former *Example*, for 14 Foot of breadth, that the *Ship* is allowed to be there, ſet it off from the Line B C, off to Q at F, and draw the Line L M, then from the prick'd Line at Q ſet off 7 Foot to L, and 7 Foot to M, which is 14, the Breadth of the Ship there. Then from the Point H to the Point L, ſweep an Arch, as the Arch H L, that ſhall be the narrowing of the ſide of the Ship from H to L. In the ſame manner muſt you work for the narrowing of the ſide from K to O, and from I to N Aft, and G to N on the contrary ſide Forward. Then from L to F, the rounding Forward is an Arch of 12 foot ſweep, and cometh in the middle of the ſquare of 7 Foot, which is commonly allowed at Pleaſure. The Line N O, is the breadth of the Tranſome, 12 Foot above the Gun-Deck P, the Breadth under the Deck in 7 Foot of the Stern-Poſt, and 11 Foot in Breadth, is the Work under the Tranſome.

Note, The extream Breadth at the height of Breadth is wrought diverſly, ſome place it at the Midſhips and continue it in length, others at third, ſome two or three Foot below the 2 thirds of the Ship forward, but few paſſing the two thirds. Then the proportion of narrowing Forward and Aft muſt be as you deſign for Sailing or Burthen

The

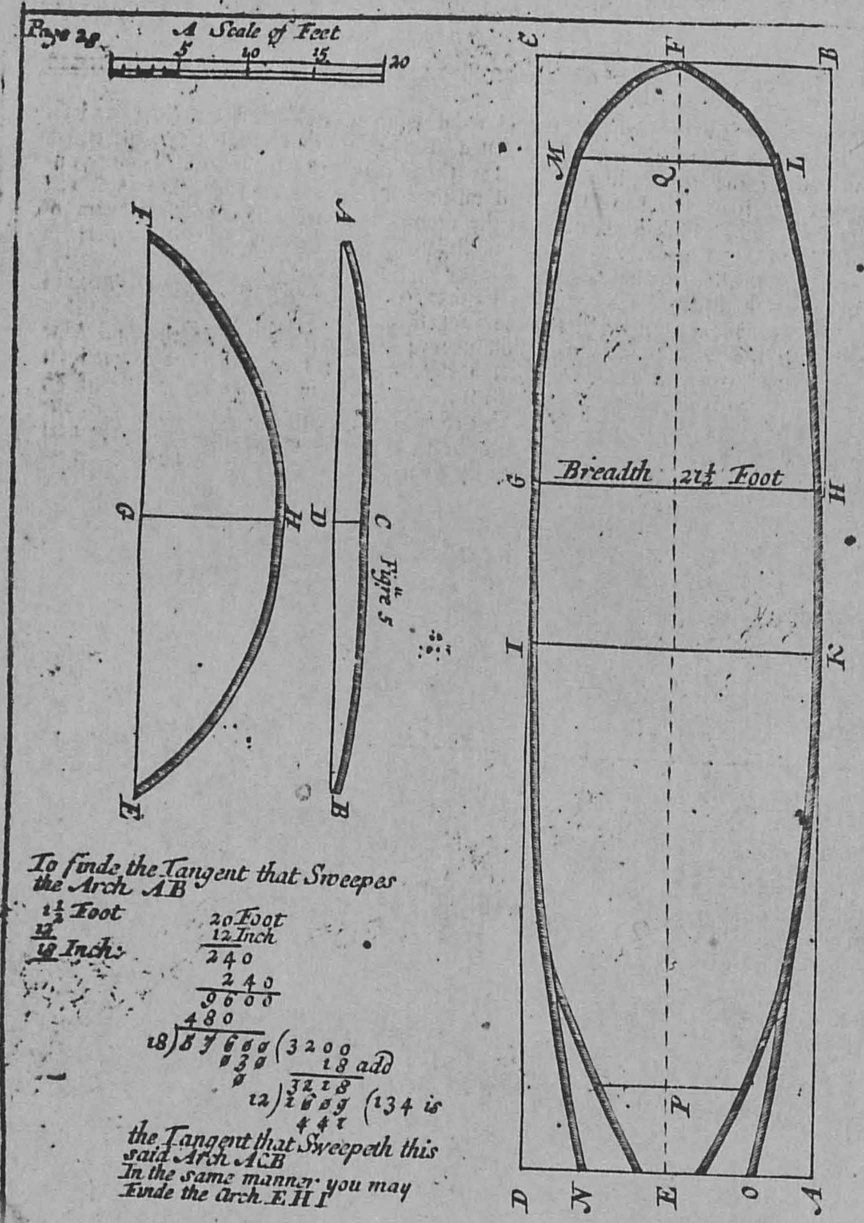
The Deſcription of the rounding of a Beam or Bend, of any Piece of Timber.

Example. Suppoſe a piece of Timber be 40 Foot long, and it ſhould round 18 Inches.

The Work. Draw the Line A B, and from your Scale take off 40 Foot, and ſet thereon from A to B figure 5; then divide it into two equal parts, as D, and draw the perpendicular D C; then take 18 Inches off from your Scale, and ſet it on the Line D C, and make a Prick at C. Then thro' A C and B, draw an Arch, which Arch ſhall be the cropping or rounding of that Beam of 40 Foot, and the Tangent that ſweepeth the Arch ſhall be 134 *Foot*, as appears in the work by Arithmetick hereunder.

Example 2. A piece of Timber or Arch that roundeth 10 Foot, being 40 *Foot* in Length, the rounding is required, and the Tangent that ſweepeth it.

Draw the Line E *F*, on which ſet off your 40 *Foot*; then divide the ſaid Line into two equal parts, as at G, and erect a Perpendicular Line from G to H, and ſet off ten *Feet* from your Scale, from G to H; then ſweep an Arch thro' E H and F; and that Arch ſhall be the Arch of 10 foot rounding, for 40 foot in length, and the Tangent that ſweepeth it will be found to be 25 foot, as appears by the Arithmetical Work, and alſo by Meaſuring the Extent by your Compaſſes on the Scale of Feet.



Demonstrating the Making, Graduating, and Marking out a Bend of Molds.

Example. Suppose you would Frame a Mold for 21 Foot 6 Inches, in the breadth, which lyeth in height from the Keel 11 Foot, and the breadth of the Floor 10 Foot, your dead rising 9 Inches, then allow 4 Foot in depth from the height of the depth to the upper Deck and 3 Foot 4 Inches, for the depth at the Waste. Apply your self to some convenient place that will contain the length and breadth of your Ship, or Vessel, then draw a Line on your Plat-Form, as the Line A B of 21 Foot 6 inches, which shall represent the Floor; then from the end of this Line A B, at A erect a Perpendicular, whose length must be 18 Foot 4 Inches, the depth of your Ship at the Waste, in the midship or Loof, at the *Frame* of the extream breadth, this depth will fall in ⊙ and V, thro' these 2 Points draw a Line, then have you the figure of a Parellelogram or Oblong Square, as the figure A B K I ⊙ V represents, then set off from A to I 11 *Foot*, and from B to K 11 *Foot*, and draw a Line with your Rulling Staff from I to K, and that Line shall be the height of your extream breadth in your main *Frame*. Then divide the Line I K and A B into 2 equal parts as at C and D, and draw a Line thro' C and D to the Line O V, which Line is the middle of the Frame of your Ship, then take off 10 Inches from off your *Foot* Rule, and set that 10 Inches on the Line B K and A L, and draw a Line Parallel to A B, which Line is your *Floor*, then take 5 Foot and measure that on the *Floor*, from the Line D C, and from C to G, and D to H, and from C to *F*, and D to E, then draw a Line from *E* to *F*, and from H to G, and where these 2 Lines toucheth the *Floor*, there is the length of your *Floor* Timber, which is called the *Floor* Timber Head, which hath 10 Inches dead rising from the Keel, then draw a Line from D to B, and from D to A, these 2 Lines are called Tangent Lines, then divide the 2 Tangent Lines each of them into 9 equal parts, at 2 of those from B to D, and from A to D make a mark, as at e and e, then from the Point O on the Line H G, setting one Foot of your Compass thereon, and sweep part of an Arch to the Point E on the Tangent Line, which Arch is called the Navel Timbers, and where they are Scarf together the wrong Heads, then from Point e on the Tangent Line, setting one Foot of your Compasses upon the Line I K, with the other sweep the Arch e K, continuing the said Arch 2 Foot above the Line I K, at K, the same do on the other side of your *Frame*, from e to e and from e to I, part of this Arch is called the Futtocks, then from the extream breadth at V, on the Line O V, set of 2 Foot by your 2 Foot Rule, from the Line B K to V, and make a prick, then from the Sweep or Arch e K 2 Foot, above the Line I K, draw a Line to V, and that Line shall be the Mold for your Top Timber, to the top of the Gun-Wall in the Midship, or at the greatest *Frame*, so is your main *Frame* finished.

How to make your Mold for your main Frame.

Apply your self to your Scheme or Oblong Square, and by the sweep of your Frame there make your Molds exactly by those Sweeps, making on them sirmarks that you may lay them together in their true places, first make the Mold for your *Frame*, as the Line F G, which is 10 Foot, then make a Sirmark by the Line F e, on the Head of the Floor Mold, and another at the Foot of the Navel Timber Mold, at F F, which signifie that when these 2 Marks are put together they are truly placed, and will agree when any Timbers are Molded by them; then mark your Sirmarks on your Timbers also;

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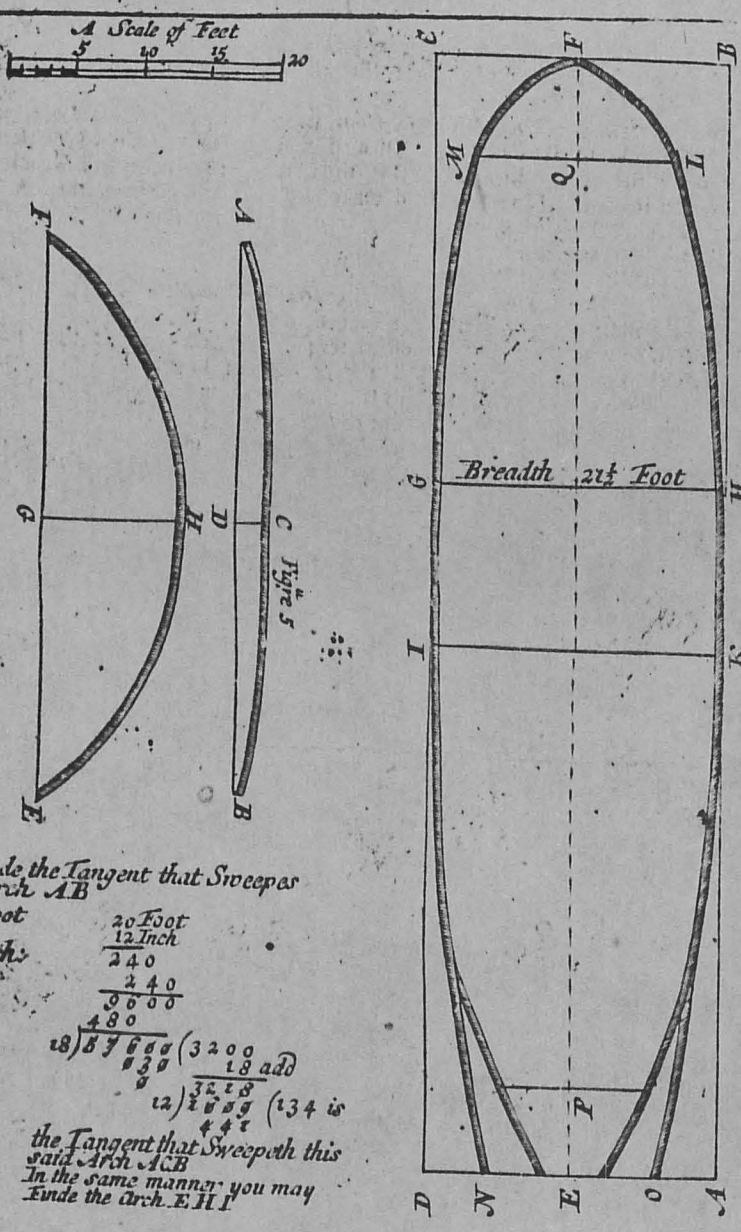

To finde the Tangent that Sweepes the Arch AB

21½ Foot
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18 Inch.

20 Foot
12 Inch
240
240
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480
18)8760(3200
0
39
18 add
12)3618(134 is
44
2

the Tangent that Sweepeth this said Arch AB

In the same manner you may finde the Arch EHI

Demonſtrating the Making, Graduating, and Marking out a Bend of Molds.

Example. Suppoſe you would Frame a Mold for 21 Foot 6 Inches, in the breadth, which lyeth in height from the Keel 11 Foot, and the breadth of the Floor 10 Foot, your dead riſing 9 Inches, then allow 4 Foot in depth from the height of the depth to the upper Deck and 3 Foor 4 Inches, for the depth at the Waſte. Apply your ſelf to ſome convenient place that will contain the length and breadth of your Ship, or Veſſel, then draw a Line on your Plat-Form, as the Line A B of 21 Foot 6 Inches, which ſhall repreſent the Floor; then from the end of this Line A B, at A erect a Perpendicular, whoſe length muſt be 18 Foot 4 Inches, the depth of your Ship at the Waſte, in the midſhip or Looſ, at the Frame of the extream breadth, this depth will fall in ⊙ and V, thro' theſe 2 Points draw a Line, then have you the figure of a Parellelogram or Oblong Square, as the figure A B K I ⊙ V repreſents, then ſet off from A to I 11 Foot, and from B to K 11 Foot, and draw a Line with your Rulling Staff from I to K, and that Line ſhall be the height of your extream breadth in your main Frame. Then divide the Line I K and A B into 2 equal parts as at C and D, and draw a Line thro' C and D to the Line O V, which Line is the middle of the Frame of your Ship, then take off 10 Inches from off your Foot Rule, and ſet that 10 Inches on the Li … which Line is your Floor. then

TIGHTLY BOUND Volume.

ſignifie that when theſe 2 Marks … when any Timbers are Molded by them; then mark your …

alſo, and when you put your Timbers up in the Frame, you muſt compare Sirmarks; with Sirmarks, that each Timber may be in his proper place, and reſt in its own breadth, that your Veſſel may have the true form you aſſigned her by your Draught. Thus you muſt proceed for all the other Molds.

How to make your Molds ſmaller upwards.

Example. Firſt meaſure the depth of your Frame, as it roundeth. Thus the Timber at the round Heads at e, is 9 Inches from e to e, is 4 Foot from e to K, is 9 Foot from K to V, meaſured off from the Scale of feet in 7 foot and 6 Inches, all put together gives the length of the ſide 2 foot 31 Inches, and at the head of the Timber, on the top at the Gunwald, is 4 Inches. Then draw a Line as the Line P O, ſet 8 thereon 21 Foot 3 Inches from P to O, for the length of the rounding of your Frame. Then at ⊙ to ⊙ ſet off the diſtance of 9 Inches, the thickneſs of your Timber at the round heads. Then at P ſet off 4 Inches from P to P. Then from ⊙ to P draw a Line, and that Line is the narrowing of your Timbers upwards, meaſure from the end of the Floor, from the Point G to K, at the breadth is 14 Foot ſet off from O O and P P, ſignifieth at the Sirmark there, which ſheweth the thickneſs to be 7 Inches, which thickneſs the Mold ought to be at the midſhip, or breadth of the Veſſel.

By this proportion is your Molds made and Sirmarks to the extream breadth or Body of the Veſſel, then to order them to find the decreaſe of her Bulks Body, from her mid-Ship, that ſhe may have clean way for the Water to paſs Aft, that may be Gondable and Steer. Apply to your Draught and ſet of the riſing of her Timbers thus.

How to ſet off the Riſing, Narrowing, of the Floor and Side, with the Height of Breadth of Timber 14 Foot Aft.

Example. The Dead Riſing at 14 foot is 1 foot, the narrowing of the Floor 6 Inches, the Height of Breadth lying higher Afteron 2 foot then at the looſe, at 14 foot will be 7 Inches, the narrowing of the ſides 6 Inches. Take the Dead Riſing from your Scale, and ſet it off from your Floor e and e, and draw a Parallel Line to e e, and that Line will be the Floor for your Mold at 14 Foot; then ſet off the narrowing of your Floor, upon the firſt Floor, and upon the Floor 14 Foot, and make a Prick, and where that Mark is, ſet on each ſide H G and E F, is the Length of the floor 14 foot from the looſ; then ſet off the Height of Breadth 6 inches on your Frame at I and K, and where it cutteth at D, draw a Tangent Line from D to P. The Prick Line from the floor to P, and from the narrowing of the ſide from the Height of Breadth makes an Oblong ſquare, that gives your Tangent Line, divided into 9 equal parts, 2 of them gives the Point e. An Arch ſwept from e to e is the Navel Timber for this Mold; then an Arch ſwept from E to the Height of Breadth, at the end of the Prickt Line P, and 2 foot above it is your Futtock; then ſet off your narrowing 6 Inches of your ſide more than at the Midſhips, which is 2 Foot and 6 Inches, and draw a Line from the top of the former ſweep, and that will be the Frame of your top Timber. Thus are all the reſt of the Timbers wrought.

How to ſet off on your Platform the Timber at 24 Foot Aft.

The Riſing of this Timber is 2 Foot 5 and a half Inches from the Keel, and narrow at the floor 1 Foot 2 Inches and one half; the Height of Breadth lyeth 14 Inches higher

higher than in the Midſhips, the narrowing of the Breadth 1 foot 7 Inches, where ſhe tumbleth Home at the Height on the top of the ſide.

Example. Set off 2 Foot 5 Inches and a half from your Keel, and draw a Parallel Line for your floor, ſet off the narrowing of the floor 1 Foot 2 Inches of a ſide, and that ſhall be the length of the floor; then ſet off the Height of Breadth 14 Inches from the Line I K, and the narrowing of the ſide 1 Foot 7 Inches. Draw your Tangent Line, and ſweep your Arch as in the Example of Timber you are directed.

The Timber at 34 foot and 42 in the Frame middle, are wrought by the ſame Rule as you are directed for the main frame, and for the Timber at 14 foot Aft, the like you muſt do for your Timbers Forward, the Arithmetical and Geometrical Work being the ſame for any Timber in the Bulks Body Forward or Aft.

How to make your Molds for any of theſe Frames.

Having ſet off the Height of all the riſing (narrowing of the floor, narrowing of the Breadth, Height of Breadth, at the breadth of your Frame or Veſſel, and breadth at the head of the top Timbers) proceed, and prick down a Nail at each Point of the floor, beginning at Timber 14 foot, at each Point of the floor; ſtick one in the Mid-ſhip Line at 14, another at the narrowing of the floor at Timber 14 foot, another at height of breadth, and one Timber 14 foot, another at the Head of the Top Timber 14, then take a lower Futtock Mold, and an Upper futtock, called a Navel Timber Mold, and a futtock Mold, Nail them together, then lay the Sirmark of the frame Mold and futtock Mold, to the Nails that are ſtruck in the narrowing of the floor; by ſo doing the floor Mold and futtock Mold is halved downward, then mark the Midſhip Line C D with 14, then ſee exactly that the Navel Timbers touch the Nail at the breadth, and at the narrowing of the floor, keeping the lower Sirmark to it, then make a mark at the Futtock Mold, at the upper Nail, mind the riſing below liſteth up the Molds higher, and what by marks or croſſes is made at the Foot of the Navel Timber, or Head of the Floor Mold, mark it, and ſet the mark 14 to it, ſo you may know how to lay them together again, then keeping the Futtock Mold faſt, lay to the Top Timber Mold the breadth of the Sirmark of the Top Timber Molds, to the Nails at the breadth of the Ship, you have no more Sirmarks on your Top Timber Molds, then guide the Head of him, while a Line ſtretched from the Croſs or Mark at the Head of the Top Timber, be exact with the right part of the Top Timber Mold, then ſee the croſſing of the Foot of the Top Timber Mold, and the back of the Futtock and mark it 14, that by this means they may come to their proper places; having finiſhed for this Mold, I remove my Mold and Nails to Timber 24 Foot, and prick in my Nails in all the Marks of 24, then laying down the Molds, the Floor Mold to the Sirmark of 24, on the narrowing of 24, and to the Nail, ſtriking on the Line D C, in the midſhips, right on the ſame Line, at the croſſing, make a mark at the Floor Mold, that Mark will be the narrowing of the Floor, then your Futtock Mold lay down placing the Sirmark, on the Foot to the Nail, on the narrowing of the Floor, keeping the Mold to touch the Nails at both places, make your mark for the breadth Sirmark at 14 on your Futtock Mold, and ſet to it 14, then lay down your Top Timber Mold, the breadth Sirmark to the Nail, ſticking at the height of the breadth, that the upper end on the backſide may range fair by a Line from the mark at the upper end of the Top Timber at 14, that by the back of the Top Timber Mold a ſtrait Line will agree thereto, keeping faſt the Molds, mark the croſſing of the Foot of the Top Timber Mold, by the back of the Futtock, on the Foot of the Top Timber Mold with 14, ſo that where ever theſe Timbers are framed they may be put together, and no miſtake made. Thus you may order your Molds for as many

many Frames as you pleaſe. After this manner you may make your Molds for all Circles, Elipſes, or Sweeps whatſoever deſigned, in their proportions, either for Burthen or Sailing, or both.

How to order the hollow Molds Afteron and Forward.

The prick'd Line O P at the *Sceeg* in the Frame, or the Model of the *Ship*, is a Riſing Line in the Model, for to order and make a hollow Mold by the Timbers from this Arch to the Sceeg, marked O and P, take off all the Riſings, and mark them on the Riſing *Staff*, on one ſide or edge thereof; and diſtinguiſh them from the other Riſings, as here 34 Foot Timber, the hollow Riſing 1 Foor, ſet it off on the Riſing Staff, 1 Foor, the uſe of it will be for Molding, ſet it off in the middle of the Riſing of the Timber, when the Molds are laid, and ſtrike a *Line* from this Riſing on the middle Line until it breaks off, on the back of the Molds, then lay the hollow Mold to the lower part of the Brich of the Timber, and at the half breadth of the *Keel*, and bear in the other Mold, that it touch the ſtrait Line made by the hollow Riſing, and the back of the Molds, ſo the lower part of the hollow is brought in very fair. Thus you muſt do for your Body forward, marking your hollow Riſing, on the other ſide of your Mold, that you may make no miſtake. Now for the hanging of your Walls, mark every 3d Timber, or 4th or 5th, at the height you deſign to lay them at in your *Frame*, whether it be the upper edge or lower edge, and anſwer the Walls on the other ſide, with an exact Parallel, making both ſides equal; this ends the Demonſtrative part of a *Ship*, (the curious projecting part is more Copious than my Limit will contain, it will afford a Volume in it ſelf, and other kinds of Work) always lay your Walls as high as poſſible, not to moone, ſharpen or Circular. This Semingly drowns a *Ship*, nor too ſtrait, which gives ſuſpiſion of a bent *Keel*, but take the Medium, or rather inchine to ſtrait then Circular.

The

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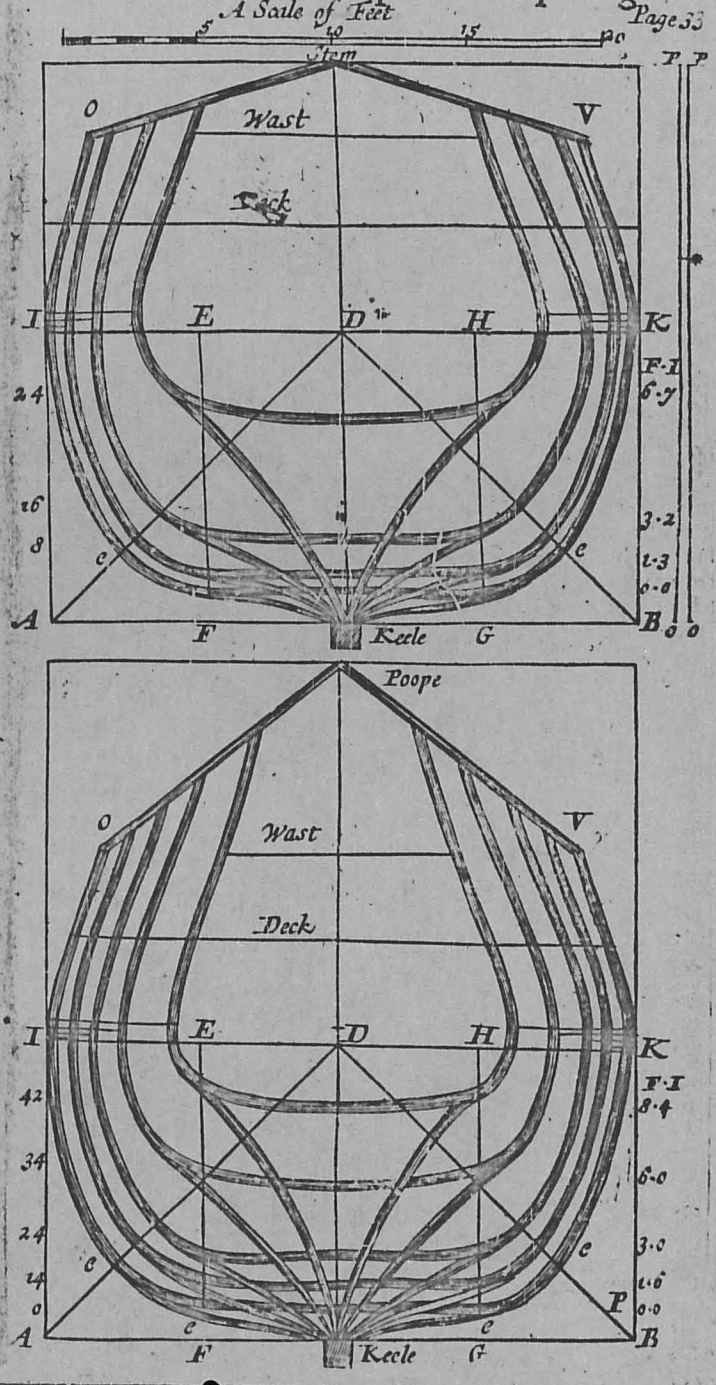


This Figure Repreſents the Narrowing of the Frames forward, from the Floor Timber-Heads to the end of the top Timber upward in their Proportion.

This Figure A B and O V Deſcribes the Frames forward As the Frame 8 Foot Forward from the greateſt Frame at the looſe, and 16 Foot, and the Frame of 24 foot Forward, with their Riſing, Narrowing and Height.

This Scheme or Figure demonſtrates the Main Frame at the looſe which lyeth in 3 Foot of the 2 thirds of the Keel forward. Then the Frame 14 Foot Aft, and the Frame 24 Foot, and the Frame 34 Foot, with the Frame 42 foot Aft. From the Extream Breadth, The Work Forward or Aft is the ſame, keeping to two ninths of your Tangent Line.

If you Proportion your Tangent Line to be divided into 20 parts, take Four of thoſe parts it

I will

will give your Floor ſomewhat rounder that you wil come between an Eliptick Circle, and the former Proportion.

How, by Geometry and Arithmetick, to Frame the Body of a Ship by Segments.

Example THE length of the Riſing of the Floor, is in the figure A B C D, from the Stem Aſt 31 foot, with 9 foot dead riſing; and the figure adjoyning A E F G is 30 foot in length for the Riſing, and 10 foot the Dead Riſing, that you may ſee the difference of every 5 foot, which ſerve to help your Judgment in Proportions, to come the nearer to what you intend.

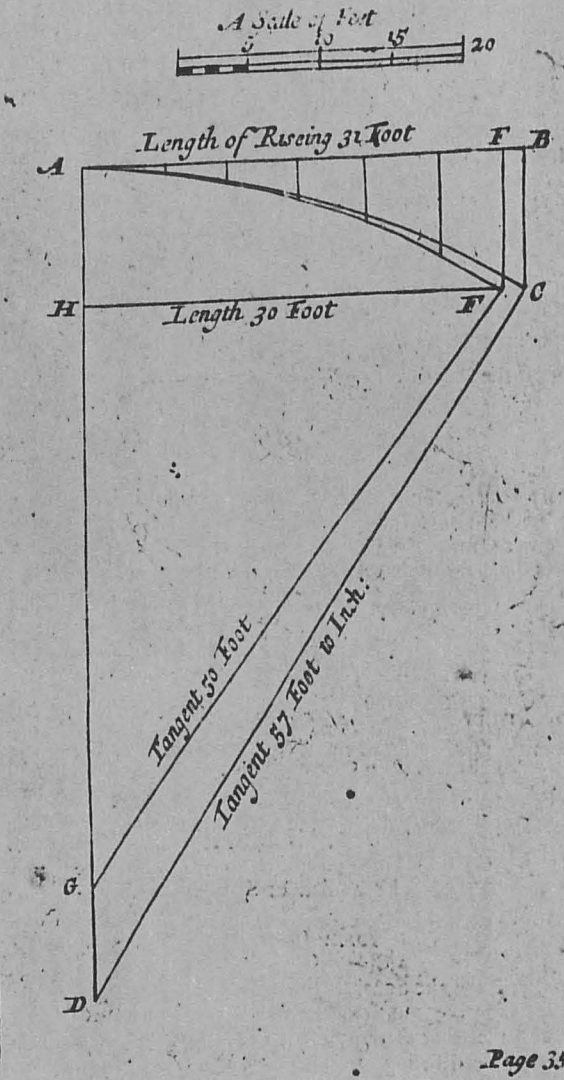
Brief Directions for the Demonſtration thereof.

Draw the Line A D, raiſe a Parpendicular at A, ſet off 31 Foot from A to F, at B let fall a Perpendicular, ſet off 9 Foot from B to C, then from A to C ſweep an Arch, and divide the Line A B into 6 equal parts, each part containing 5 Foot, then 1 Foot from each part, let fall a Perpendicular, or draw a Parallel Line, from the Line A B to the back of the Arch A C, theſe Lines are the length of the Dead Riſing of every 5 Foot, this Arch is ſwept by a Tangent Line of 57 Foot 10 Inches, then at 30 Foot Dead Riſing, 10 Foot, the Tangent that ſweepeth it is 50 Foot, the difference is 10 Inches at 25 ſo of the reſt.

How

How, by the Table of Squares, to find the aforeſaid Tangent.

Example. Look into the Table of the Squares for 31 Foot, right againſt it is 138 384 Squares of the Inches, in 31 Foot, then convert your Dead Riſing into Inches, which is your Diviſor, unto the Quotient add 108, the Inches in the dead Riſing is 9 Foot, and take the half ſum which Sum, brought into Feet and Inches, is the Tangent of the Arch A C.



The Work by Arithmetick.

9 Foot.
12 Inch.

100 Inch.

31 Foot.

138384	(	1281	
030746	(	add 108	
0810		1389	
(80		half 694	

Inch. F. In.

12) 694 (57 10
090

the Tangent

That ſweep the Arch A C.

How, by the Table of Squares, to find the Dead Riſing for every Foot of any Ship.

Suppoſe the length here 30 Foot, (of the riſing Line forward) and 10 foot dead riſing: It is required the Dead Riſing of each Foot, from the beginning at 1 to 30 Foot.

To find the Tangent.

Square your 30 Foot, after you have brought it into Inches; then reduce your Dead Riſing 10 Foot into Inches, and divide the ſquares of 30 Foot by the Inches in the Dead Riſing; unto the Quotient add 120 the Inches in the Dead Riſing; then take the one half, and bring that into Feet and Inches, and that gives you the Radiax.

The Work by Table of Squares.

10

120 Diviſor

ſquare Inches in 30 Foot.

12960,0	(	1080 Quotient
0000,	(	120 add
		1200 Aggregate
		Half
Divide by 12	600	(50 Foot.
	000	

The Radiax or Length of the Tangent.

How to find the Dead Riſing.

Example, Take the Square of the Tangent Line 50, and the Square of the Length of the Riſing Line 30, Subſtract the one from the other, the Remainder is a ſquare number found, the Root thereof, in the Table of Square Subſtract out of the Tangent Line, giveth the Dead Riſing.

The

The Work by the Table of Squares.

The Square of 50 00 is	360400	50 00	Rad.
The Square of 30 00 is	129600	40 00	Sub.
The Side found 40	230000	10 00	Foot.

The Dead Riſing at 29 Foot.

Square Rad.	360000	50 00 Rad.
Square of 29	121104	40 08½
Square found	238896	9 3½

Is 40 8½

The Dead Riſing 9 Foot, 3½

The Dead Riſing for each Foot followeth, Wrought by the aforeſaid Rule

The length of	F.	In.	The length of	F.	In.
30 Foot is	10	00	15 Foot is	2	3¾
29 Foot is	9	3½	14 Foot is	2	0
28 Foot is	8	6	13 Foot is	1	8¼
27 Foot is	7	11	12 Foot is	1	5½
26 Foot is	7	3¾	11 Foot is	1	3
25 Foot is	6	6	10 Foot is	1	0
24 Foot is	6	1½	9 Foot is	0	10
23 Foot is	5	8½	8 Foot is	0	7¼
22 Foot is	5	2	7 Foot is	0	6
21 Foot is	4	3	6 Foot is	0	3¾
20 Foot is	4	1¼	5 Foot is	0	2½
19 Foot is	3	9	4 Foot is	0	1¾
18 Foot is	3	4¼	3 Foot is	0	1½
17 Foot is	2	11¾	2 Foot is	0	1
16 Foot is	2	7¼	1 Foot is	0	½

The Geometrical and Arithmetical Demonſtration of the Reſing of the Floor Aft.

Example.

The Length of the Riſing Line, from the Looſe at the extream Breadth Aft 49 foot, the Dead Riſing Aft is 11 Foot 6 Inches, by the former Rule you have the dead Riſing for each Foot, and the Figure to prove it.

The

The Tangent found that ſweeps this Arch 110 *Foot* 1 *Inch.*

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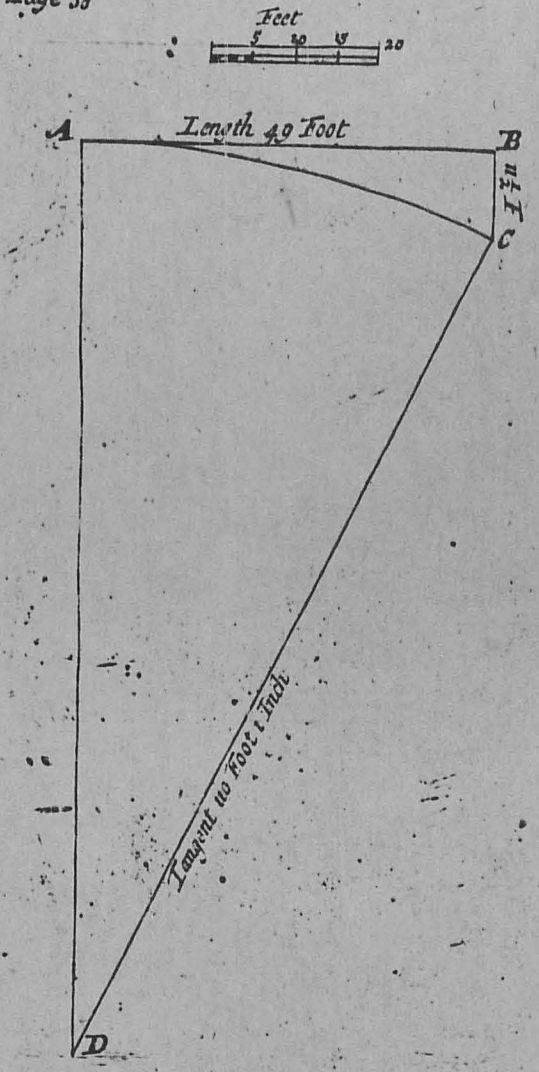


	F.	In.
49 Foot is	11	06
48 Foot is	11	1
47 Foot is	10	7
46 Foot is	10	1
45 Foot is	9	9
44 Foot is	9	3
43 Foot is	8	10
42 Foot is	8.	4
41 Foot is	8	0
40 Foot is	7	5
39 Foot is	7	1
38 Foot is	6	9
37 Foot is	6	5
36 Foot is	6	1
35 Foot is	5	8
34 Foot is	5	5
33 Foot is	5	1
32 Foot is	4	9
31 Foot is	4	5½
30 Foot is	4	2
29 Foot is	3	10½
28 Foot is	3	8⅓
27 Foot is	3	3⅓
26 Foot is	3	0⅓
25 Foot is	2	10½
24 Foot is	2	7½
23 Foot is	2	5½
22 Foot is	2	2¼
21 Foot is	2	0½
20 Foot is	1	10
19 Foot is	1	7⅓
18 Foot is	1	5⅓
17 Foot is	1	4
16 Foot is	1	2
15 Foot is	1	1⅓

The Length of	F.	In.
14 Foot is	0	10¾
13 Foot is	0	9¼
12 Foot is	0	7⅔
11 Foot is	0	6½
10 Foot is	0	5½
9 Foot is	0	4
8 Foot is	0	3¼

The Length of	F.	In.
7 Foot is	0	3
6 Foot is	0	2
5 Foot is	0	1¼
4 Foot is	0	1½
3 Foot is	0	1¼
2 Foot is	0	1
1 Foot is	0	0½

The Arithmetical Work by the Table of Squares, Wrought for the narrowing of the Floor Forward, and Afteron.

The Breadth of the Floor is 10 Foot, the Half thereof is 5 Foot, the narrowing of the Floor at 30 Foot in length Forward, and the length of the Floors narrowing Aft 49 Foot, the breadth 5 Foot, wrought by the Table of ſquares in Feet and Inches, as you are taught before.

The narrowing of the Floor Forward, from 30 *Foot to* 1, *the Tangent Line that ſweepeth the Arch is* 92 *Foot* 6 *Inches.*

	F.	In.
30 Foot is	5	0
29 Foot is	4	8
28 Foot is	4	4
27 Foot is	4	0
26 Foot is	3	9
25 Foot is	3	5
24 Foot is	3	2
23 Foot is	2	11
22 Foot is	2	8
21 Foot is	2	5
20 Foot is	2	3
19 Foot is	2	0⅙

	F.	In.
18 Foot is	1	9
17 Foot is	1	7
16 Foot is	1	5½
15 Foot is	1	2½
14 Foot is	1	1
13 Foot is	0	11
12 Foot is	0	9½
11 Foot is	0	8
10 Foot is	0	7
9 Foot is	0	6
8 Foot is	0	4⅓
7 Foot is	0	3
6 Foot is	0	2⅓
5 Foot is	0	1⅓
4 Foot is	0	1
3 Foot is	0	0⅓
2 Foot is	0	0⅙
1 Foot is	0	0⅓

The

The narrowing of the Floor aft, from 49 Foot to 1, the Tangent Line that ſweepeth this Arch is 242 Foot 7 Inches.

	F.	In.
49 foot is	05	00
48 foot is	04	10 1/4
47 foot is	04	07 1/4
46 foot is	04	04 3/4
45 foot is	04	02 1/2
44 foot is	04	00 1/4
43 foot is	03	10
42 foot is	03	8
41 foot is	03	05 3/4
40 foot is	03	03 3/4
39 foot is	03	02
38 foot is	03	00
37 foot is	02	10 1/4
36 foot is	02	08 1/2
35 foot is	02	06 1/2
34 foot is	02	04 3/4
33 foot is	02	03
32 foot is	02	01 1/2
31 foot is	02	0 1/4
30 foot is	01	11 1/4
29 foot is	01	09
28 foot is	01	07 1/2
27 foot is	01	06 1/4
26 foot is	01	05
25 foot is	01	03 1/2
24 foot is	01	02 1/2
23 foot is	01	01 1/4
22 foot is	01	00
21 foot is	00	11
20 foot is	00	10
19 foot is	00	09
18 foot is	00	08
17 foot is	00	07
16 foot is	00	06 1/2
15 foot is	00	05 1/2
14 foot is	00	04 1/4
13 foot is	00	03 1/2
12 foot is	00	03
11 foot is	00	02 1/4
10 foot is	00	01 1/4
9 foot is	00	02
8 foot is	00	1 1/2
7 foot is	00	01 1/4
6 foot is	00	01
5 foot is	00	0 3/4
4 foot is	00	0 1/2
3 foot is	00	0 3/8
2 foot is	00	0 1/8
1 foot is	00	0 1/8

The Demonſtration and Work by the Table of equal Squares, for the narrowing of the Deck for 30 Foot.

Example. The length of the ſide from the extream breadth, at the Looſ forward, is 24 Foot, and narroweth 3 Foot 7 Inches, and the length of your ſide aft is 42 Foot, and narroweth 4 Foot 7 Inches on each ſide, wrought by the ſame Rule as to find the Dead Riſing.

The

The narrowing of the ſide forward, from 24 Foot to 2 Foot, the Tangent that ſweepeth the Arch of the narrowing of the ſide is 82 Foot 2 Inches.

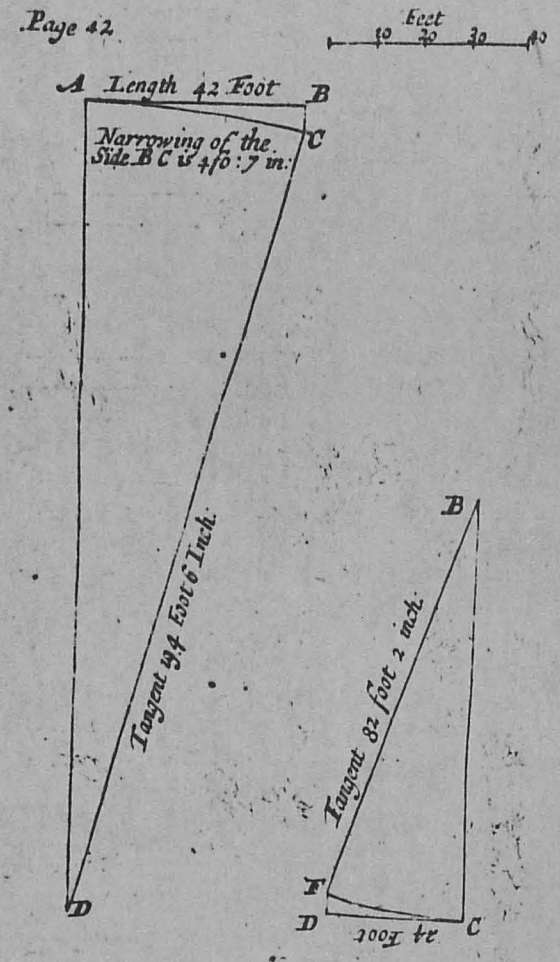
	F.	In
24 foot leng. of the ſide	3	07
23 foot is	03	04
22 foot is	03	00
21 foot is	02	9 1/2
20 foot is	02	00
19 foot is	02	2 1/2
18 foot is	02	0 1/2
17 foot is	01	10
16 foot is	01	7 1/4
15 foot is	01	5 1/4
14 foot is	01	2 1/2
13 foot is	01	0 1/2
12 foot is	00	9 1/2
11 foot is	00	9
10 foot is	00	6 1/4
9 foot is	00	6
8 foot is	00	5 1/4
7 foot is	00	3 3/4
6 foot is	00	3 1/4
5 foot is	00	2
4 foot is	00	1 1/2
3 foot is	00	1
2 foot is	00	0 1/2
1 foot is	00	0 1/4

The narrowing of the ſide Aſt, from 42 Foot to 1 Foot; the Tangent that ſweepeth the Arch of the narrowing of the ſide Aft is 194 Foot 6 Inches.

	F.	In.
42 Foot length of the ſide	4	07
41 Foot is	4	4 1/2
40 Foot is	4	2
39 Foot is	3	10 1/2
38 Foot is	3	8 1/2
37 Foot is	3	6 1/2
36 Foot is	3	4
35 Foot is	3	2
34 Foot is	3	0
33 Foot is	2	10
32 Foot is	2	7 1/2
31 Foot is	2	5 1/2
30 Foot is	2	4
29 Foot is	2	2
28 Foot is	2	0 1/2
27 Foot is	1	10 1/2
26 Foot is	1	8 3/4
25 Foot is	1	7 3/4
24 Foot is	1	5 1/4
23 Foot is	1	4 1/4
22 Foot is	1	2 3/4
21 Foot is	1	2 1/2
20 Foot is	0	11 1/4
19 Foot is	0	10 1/2
18 Foot is	0	10
17 Foot is	0	9
16 Foot is	0	8
15 Foot is	0	7
14 Foot is	0	6
13 Foot is	0	5 1/4
12 Foot is	0	4
11 Foot is	0	3 1/2
10 Foot is	0	3
9 Foot is	0	2 1/2
8 Foot is	0	2
7 Foot is	0	1 1/2
6 Foot is	0	1
5 Foot is	0	0 3/4
4 Foot is	0	0 1/2
3 Foot is	0	0 3/8
2 Foot is	0	0 1/4
1 Foot is	0	0 1/8

The Tangent 82 Foot 2 Inches narrowing of the ſide Forward, which ſweepeth the Arch C D, 3 Foot 7 Inches at 24 Foot the length of the ſide.

The Tangent 194 Foot 6 Inches is the narrowing Aſt, all which ſweepeth the Arch H C at 4 Foot 7 Inches at 42 Foot length of the ſide.



Note, The narrowing of the ſide at the height of the Breadth Forward or Aſt, is of the ſame Nature, and wrought by the ſame Rule, as you do for your Dead Riſing, or for to find the narrowing of your Floor, only differ in the length of the ſide, and the narrowing thereof as you pleaſe, to determine greater or leſſer. Now from 24 Foot Forward to the Stem, a fair Sweep anſwering to half the Square of 7 foot, ſome Builders goeth without it, and others within it, as they deſign a Round, or Sneaker Bow.

How

CHAP. V.

How, Geometrically, to deſcribe the Model of a Ship in all her parts.

Example. FRom theſe Dimenſions following you may draw any Ship or Veſſel greate, or ſmaller, ſuppoſe a Ship or Veſſel be 64 Foot in length upon the Keel within the Stern-Poſt, and hath 13 Foot Rake forward, 6 Foot of this Rack to be at 1 Foot raiſed from the Keel, then to have 20 Inches Stern-Poſt, with 2 Foot Rack, and 18 Inches falls Stern-Poſt upon the Keel, brought off to 3 Inches at the top of the Stern Poſt, the breadth 22 Foot from outſide to outſide. The Frame at the extream breadth to be 21 Foot 6 Inches, the Floor 10 Foot, with 7 Inches Dead Riſing, the Beams to lay at 8 Foot and 6 Inches, from the Floor of the extream breadth, the depth at her extream breadth 9 Foot, the height from the Beams to the upper Deck 3 Foot 4 Inches, with 3 Foot Waſte in the Midſhips Dead Riſing, aft 11 Foot 6 Inches, and forward 10 Foot, the height of her breadth to riſe 18 Inches aft, and 9 Inches forward, then 14 Foot 4 Inches 2 thirds, of her main breadth for her breadth forward, within $\frac{1}{4}$ part of her length from the Stem a ſt, and 10 Foot and 9 Inches and a half of her extream breadth, within 1 14 part of her length from the Stern-Poſt forward, the upper Deck to lye in the Midſhips 14 Foot and 8 Inches from the Keel, lying 18 Inches to the Stern-Poſt, and 6 Inches forward, the Forecaſtle 15 Foot in lenght, 5 Foot in height at the bulk Head, the Steerage 5 Foot 4 Inches at the bulk Head, to 5 Foot 10 Inches afteron, Cabin and Steerage 28 Foot in length, depth of the Quarter, aft 18 Inches to 6 Inches at the Driſt forward, and 12 Inches on the Forecaſtle depth, and 4 Inches at the Driſt aft, then the extream length of the Ship forward, at 14 Foot, the length of the Stern-Poſt 21 Foot, ſtep the main Maſt 31 Foot from the Stern-Poſt, the Fore ſt 12 Foot from the outſide of the Stem, the Miſſon Maſt 20 Foot abaft, the main Ma , the Boltſprit to lay on the top of the Stem 30 Degrees, random or more, the Ports to lay 16 Inches the lower Ceiling from the Deck, let them be cut 16 Inches in depth, and 18 Inches thorow Fore and Aft, the proportion of the Ruther is half an Inch, for a Foot of length, 3 eighths to Ships of Burthen, if quick way, they require leſs proportion then ſmaller Burthens. The Deſcription followeth.

How briefly to Demonſtrate and lay down the Dimenſion.

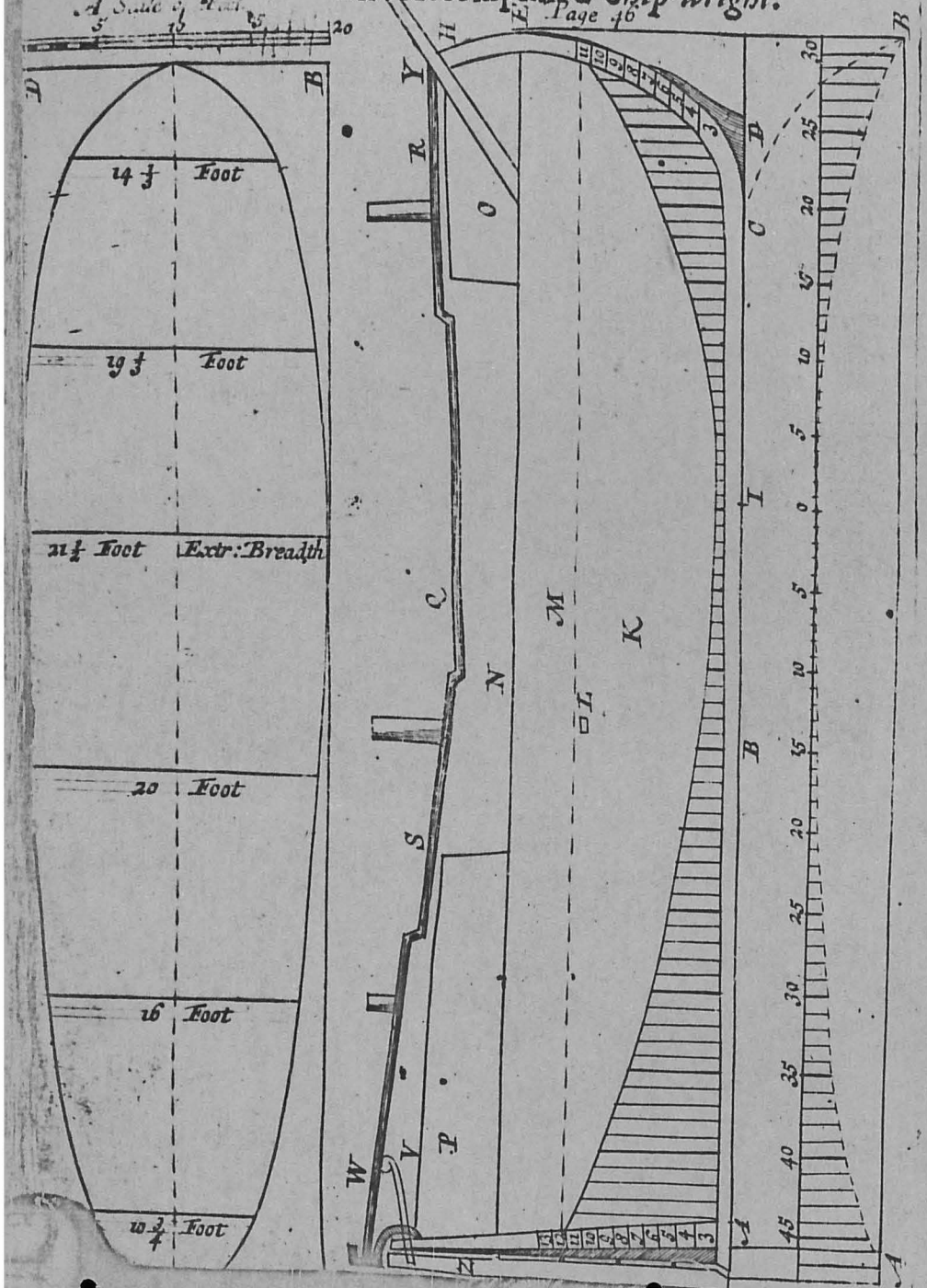
Example. In regard you are taught how to Demonſtrate and lay down the Model of a Ship, before, I ſhall be the more briefer in the explaining of this Figure, firſt draw the Line A D, ſet off 18 Inches at C, and 12 Inches at A, and draw a Line thorow thoſe 2 Pricks, and that ſhall be your Keel, and your Line A D, ſet off your extream length of 79 Foot, it is 81 Foot to the outſide of the Stern-Poſt, with the Rake, then erect 2 Perpendicular Lines, one forward as the Line B E, and aft A G, then from A to C on the Keel, ſet off 64 Foot, and from C ſet off 6 Foot forward, at D ſet one Foot and ſweep an Arch from C to D, that is your 6 Foot at 1 foot raiſe then ſweep an Arch from D to E at 14 Foot depth, and that is the ſweep of the Stem, the other ſweep from the upper part of the Keel, Demonſtrates H, then ſet 20 Inches on the Keel aft, for the Stern-Poſt and 2 Foot for its Rake, and erect a Perpendicular Line, and on that Line ſet 21 Foot

for the length of the Stern-Poſt, and draw a Line from the Keel to each prick there, and that will be the Stern-Poſt, then 18 Inches on the Keel ſet off for the falſe Stern Poſt, draw a Line from the top of the Stern Poſt, to that Point of 18 Inches, that will be your falſe Stern Poſt, then from 11 Foot Draught of Water Aft, to 10 Foot forward, draw the prickt Line, that is the Water Line, then ſet off 8 Foot 6 Inches from the Ceiling that is the height of your Beam; as D C denotes, then 9 Foot with the mark M, from the Ceiling is the height of breadth, in the Point I your Dead Riſing beginneth Forward and Aft, draw your Arch I to 10 Foot, and inſcribe 30 equal parts thereon, and draw Paralle. Lines for each part or Foot, to the back of the Arch, this ſheweth the Dead Riſing forward, the ſame do for the Dead Riſing Aft, then from the Keel ſet off 13 Foot to N for your upper Deck, then ſet off 9 Inches forward, and 18 Inches on the Stern-Poſt, and a Line forward from N and aft from N, and that ſhall be the riſing of the Deck, then ſet off 15 Foot from the Stem aft, the length of the Forecaſtle, and 5 Foot for the depth, and draw a Line to the Stem, that is, the top of the Forecaſtle Deck, then ſet off 27 Foot from the Stern forward, and that is the length of the Cabin and Steerage, then ſet off 5 Foot and 3 Inches at the bulk Head, and 5 Foot 9 Inches at the Stern, draw a Line from one to the other, and that will be the Quarter-Deck, then ſet off your height forward and aft, and lead your ſide along Fore and Aft, with your Driſts, as will be moſt becoming a Ship ſhaped, then for the narrowing of the floor ſet off 10 foot, the breadth of your floor from your Keel from D to B, and draw the Line A B, which divide into 2 equal parts, then from the Cypher ⊙ draw an Arch to B, Forwards and to A aft, then draw the diviſion of the Dead Riſing, Parallel on the figure of the narrowing of the floor, gives you the narrowing of the floor forward and aft, the prickt Circle C *B* is a ſweep for the Bow, and is ſwept by a Tangent of 15 Foot, the prick Arch afteron is the Arch of the rounding of the ſide from the head of the floor Timber to the height of breadth O and O, the Main-Maſt, Fore-Maſt, Mizen-Maſt, are places as directed, the Oblong Square A B C D, is the extream length and breadth, thus deſcribed, draw the Line B C, and ſet thereon 79 foot, raiſe a Parpendicular at B and C, then ſet thereon 21 foot 6 inches at B, the like do at C, and draw a Line from A to D, gives your figure, then divide the Line A D into 14 equal parts, then place your extream breadth at 8 and 7 tenths of a part; from your Stern forward, this is reckoned the Loof, then at 1 14th part from the Stem aft, 2 thirds of the main breadth, which is 14 foot 4 inches the breadth of your Ship there, and 1 14th part of the extream length forward, from the Stern-Poſt, half of the extream breadth is 10 foot and 9 inches, for the breadth of your Ship there, then from your breadth here to the Loof ſweep an Arch, and that Arch is the rounding of your ſide Aft, the like do Forward. Thus I have briefly Demonſtrated a Model of a Ship by Geometry.

The Explanation of the Model of a Ship; diſtinguiſhing the Parts thereof.

Example.

A Repreſents the after Part of the Keel.
B The Middle of the Keel.
C The Fore part of the Keel.
D One foot raiſed at 6 foot (reckon'd Keel.)
E The Rake foreward at fourteen foot depth.
F The Stern-Poſt 21 foot dep. 29 inch. broad, 9 inch. breadth aloft.
G The Top of the Stern-Poſt.
H The Stem whereon lieth the Boltſprit.
I From whence the dead riſing beginneth Afteron, to 11 foot 6 inches, and forward to 10 foot.
K The Hold from Stem to Stern.
L The Beams in the Hold 8 foot at 6 inches.
M The hight of breadth in the Midſhip at 9 foot.
N The Deck at 11 foot 9 inches from the Seling.
O The Fore-Caſtle 15 foot in length.
P The Cabin and Steerage 27 foot.
Q The Top of the Waſte in the Midſhips 15 foot.
R The Top of the Side or Gunnil on the Fore Caſtle.
S The Top of the Side Abaft the Main-Maſt.
T The Top of the Fore-Caſtle Deck.
U The Top of the Cabin and Tiller.
W The After drift 24 foot from the bottom of the Keel.
X The Top of the Stern 25 foot from the bottom of the Keel.
Y The Top of the Stern 19 foot from the Keel.
Z The Rudder 2 foot 10 inches broad, 23 foot long.
1. The Main-Maſt 31 foot from the Stern.
2. The Fore-Maſt 12 foot from the Stern.
3. The Mizen-Maſt 19 foot, or 20 from the Main-Maſt.
4. The Boltſprit lying 30 degrees.



The Deſcription of the Square Feet contained in the Body of a Ship forward and aft Geometrically.

Example. A Ship 79 foot in length, and 21 foot 6 inches in breadth, it is required what ſquare feet are contained in her bulks Body, briefly inſcribe your Molds, and divide your Oblong ſquare into ſquare feet, counting the ſquare feet contained in each Mold, then apply to the Arithmetical part for the Content.

How to find the Content in the Body of the Ship forward.

Example. The length from the greateſt Frame to the end of the Stem is 30 foot, and the breadth 22 foot from outſide to outſide, the ſquare feet in the main frame, and in Timber at 8 foot forward, and 16 foot, and 24 foot are required by Geometry and ſo the end forward.

Example.

Example.

The Area in Square Feet, contained in the main Frame, are 159 Foot 0 Inch. In the Frame 8 Foot, forward 148 Foot 7 Inches. In the Frame 16 Foot, forward 113 Foot 3 Inches. In the Frame 24 Foot, forward 62 Foot 0 Inches. The Contents being taken from 11 Draught of Water aft, and 10 foot forward, with 22 foot, the full Breadth from outſide to outſide, from which the Tunnage or Burthen of the ſaid Ship will be found. Likewiſe the Burthen or Weight of her when ſhe is Launched, and Conſequently what Burthen ſhe hath on Board at any Draught of Water ſhe goeth at; Wrought by Arithmetick in the following work in its place.

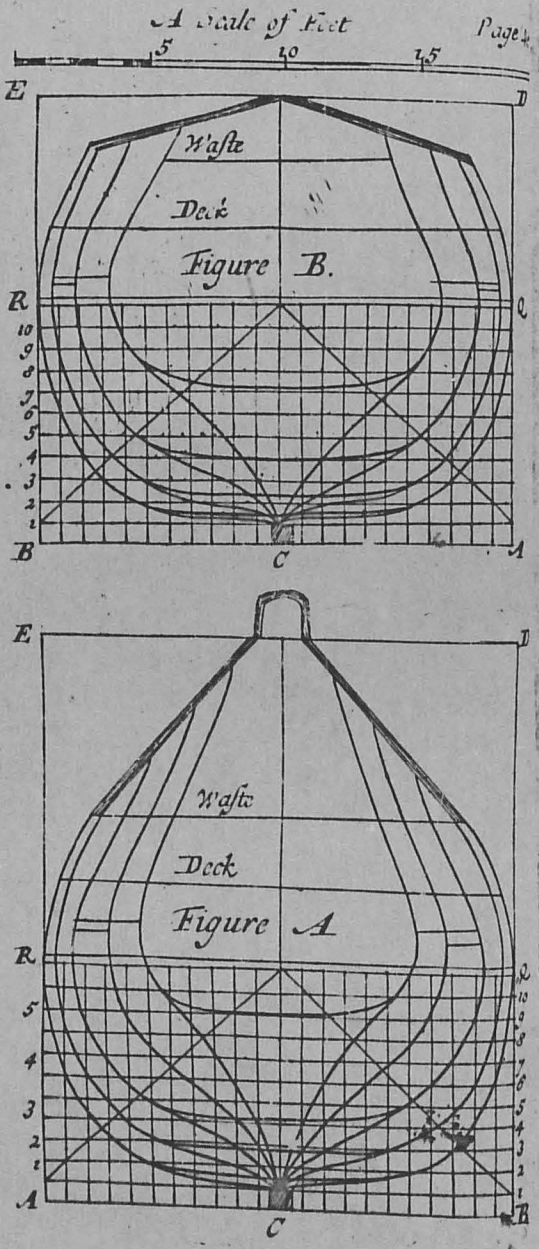
How to find the Content in the Body of a Ship aft.

The length of the greateſt frame from the end of the Stern Poſt forward, is 49 foot; the Breadth 22 feet as before: The Square feet in this main Frame, and in the frame 14 foot aft. & the Frame 24 foot, and the Frame 34 foot, and the Frame 42 feet, and to the end their Contents are required.

Example.

In this Figure the Area, in the main Frame, is 159 Feet 0 Inches. In the Frame 14 foot aft; the Area is 140 feet 0 inches; in the Figure 24 foot aft; the Area in Square feet are 105 feet 2 inches; in the frame at 34 foot aft; the Area in Square feet are 62 feet 9 inches; in the Frame 42. The Area are 34 feet 1 inch. Then from this Frame to Stern Poſt. The Content of this after part, and the Content forward added together, giveth the true Burthen of any Ship when it is exactly computed. A due Care in your Viewing of your Modes, and Proportioning your Parts is the beſt and only way to find her Trim for Sayling. Likewiſe to direct you how to place your Maſt to the beſt Advantage for Sayling.

How



How to find the Exact Burthen of any Ship or Veſſel.

Suppoſe your Ship be 79 Foot in Length, at or near the Height of Breadth, and 22 Foot the extream Breadth, and the Depth from the Bottom of the Keel to the extream Breadth 10 Foot, the exact Burthen required.

Firſt find the Content and Burthen of the Oblong Square, which is equal to the Length, Breadth and Depth of your Ship (as in the Figure) by Multiplying the Length Breadth and Depth, the one into the other, (by your Directions before given in Meaſuration) then find the Contents of the ſeveral parts of the Square, without the Ship by the precedent Inſtructions, which Subſtracted out of the whole Oblongs Content, will leave you the Contents required.

Length 79 Foot
Breadth 22

158
158

1738
10 Depth

17380 Content in Feet.
7,48 Gallons in a Foot.

139240
69520
121660

1300024,0 Gallons
8

2016 (1040016 (Tunn
515. 15 Wine

3201 18

11856 4125
516

1776 2[0) 928 5 (Tuns
18 12 464 *Averdup.*

14208 08
1776

C, 0

2016 (31968 (15
11808

1728

Of the whole Square.

To find the Burthen reduce the Contents in Feet into Liquid Meaſure, allowing one Point for a Pound) you may reduce it into Liquid Meaſure, by dividing 1728 the Inches in a Solid Foot by 231 the Cubical Inches, generally allow'd in a Gallon of Wine meaſure) which will be found to be 7 Gallons 48 Parts, which Multiplyed by the Content in Solid Feet, will give you the Content in Gallons of Wine Meaſure, which Multiply by 8, the weight of a Gallon, gives the Content of Weight in Pounds, and that Diviced by the Pounds in a Wine Tun (which is eighteen hundred Weight) namely, 2016 will give you the Content in Tuns in the whole Square.

Wine Tuns Multiplyed by 18 and Divided by 20, will give the Content of an Averdupois Tun.

How

How to find the Square Feet in the Main Frame, by the Scheme or Figure B.

Example, Number the Square feet contained in the Body, for 10 foot depth from the Keel, which is 21 foot 9 inches in breadth, and ſet it down; as likewiſe the Contents without the Body, and ſet that down; do the like for 9 foot, until all is finiſhed to the Keel.

The Square Feet in the main Frame, within the body of the Ship.				The ſquare Feet without the body of the Ship.		
F.	F.	In.		F.	In.	
10	21	9	——	0	3	Square Feet
9	21	0	——	1	0	without the
8	20	3	——	1	9	Body of the
7	19	9	——	2	3	Ship.
6	19	6	——	3	0	
5	18	3	——	3	9	
4	17	0	——	5	0	
3	15	6	——	7	0	
2	6	0	——	16	0	
1	1	0	——	21	0	
Sum	159	0		61	0	ſquare Feet.

Then apply to the Scheme B, for the Content of the Frame 8 foot Forward, ſeeking the ſquares Feet at 10 foot the Depth in the Body, ſo down to 1 Foot ſetting them down.

The Square Feet in the Body.

F.	F.	In.		F.	In.	
10	20	06	——	1	6	Square Feet
9	20	0	——	2	0	without the
8	19	5	——	2	7	Body of the
7	19	0	——	3	0	Ship.
6	18	7	——	5	5	
5	17	0	——	5	0	
4	15	9	——	6	3	
3	12	4	——	9	8	
2	5	0	——	17	0	
1	1	0	——	21	0	
Sum	148	7		71	5	ſquare Feet.

The Square of the Frame of the Timber 16 Foot Forward, from the loofe, in the Scheme B.

The Square Feet within the Body.				The ſquare Feet without.		
F.	F.	In.		F.	In.	
10	18	9	——	3	3	Squares.
9	18	0	——	4	0	
8	17	0	——	5	0	
7	16	0	——	6	0	
6	14	10	——	7	2	
5	11	8	——	10	4	
4	8	0	——	14	0	
3	5	0	——	17	0	
2	3	0	——	19	0	
1	1	0	——	21	0	
Sum	113	3		166	9	ſquare Feet.

The Square of the Frame 24 Foot Forward.

The ſquare Feet within the Body.				Squares without the Body.		
F.	F.	F.		F.	In.	
10	13	04	——	8	8	Squares found
9	11	8	——	10	4	without the
8	10	0	——	12	0	Body.
7	8	0	——	14	0	
6	6	0	——	16	0	
5	4	8	——	17	4	
4	3	0	——	19	0	
3	2	4	——	19	8	
2	2	0	——	20	0	
1	1	0	——	21	0	
Sum	62	0.		158	0	Squares.

The Square of the Body within, from the Frame 24 to the Stem, and without the Body.

Take the Content of the Frame 24, and have it, that Sum Multiply by 6 Feet the diſtance

diſtance from the Timber to the Stem: The Product is the Number of ſquare feet within; to the Content of the ſquare feet without the Body, add the Area of Feet within the Body, the Sum is the Area of the whole Square in Feet.

Squares within the Body.			Squares without the body.		
F.	In.		F.	In.	
62	00		158	0	
00	0	End	62	0	add
62	0		220	0	
31		half	031	0	half.
6		foot	189	0	add to 158
186		Feet ſquares	6	.	Feet ſquare,
to the end forward			1134	.	to the end without the the Frame Forward.

The Square contained in the body and without the body, from the loofe to the Frame 8 foot Forward. Subſtract the Contents of the Frame 8 foot forward, from the greater Frame at the Loofe, and half the difference; which half either add to the Frame 8, or Subſtract from the Content of the greater, the remainder Multiplies by 8 Feet the diſtance of the 2 Frames gives the ſquare Feet contained in this part of the Ship. Thus Work for the Content within or without, from Timber to Timber till you have finiſhed your Work Forward, add them together, and that ſhall be the Content of the Ship in her Bulk Body Forward. This ſame Work is required for her Square Feet Aft.

Example.

From the Loof to Foot 8 Forward.

	F.	In.	F.	In.	within.
Loofe.	159	0	61	05	2½ Inch.
8 Foot.	148	7	71	85	8
	10	5	10	05	20 add
half	5	2½	5	02½	
	153	9½	66	2½	9½
	8		8		8
	1230	4 Squares	520	8 without	76 (F. In. 6 4

The Squares contained from Timber 8 foot to Timber 16 foot Forward.

Example.

	F.	In.	
Timber 8 is	148	7	Inches 11 to add within.
Timber 16 is	113	3	
	35	4	11 (8 F. 7 In. 4
remain'd the ½	17	8	12 88
	130	11	04
	8		In. 1 without add
	1047	4	ſquare.

within the Body.

Square feet contained without from Timber 8 foot to 16 foot.

Example.

71	5	Inch 1 Multiply'd by 8
106	9	foot is 8 Inches to add
35	4 diff.	1 Inch.
17	8 half diff.	8 Feet.
89	1 Medium	8 Inches.
8		
712	8	Square in this part of the Ship forward.

Square feet contained from 16 to 24 foot.

F.	In.	Without. F.	In.	Within.
113	3			7½
62		106	9	8
		158	0	F.
51	3			12) 60(5 add
25	7½	51	3	Without.
		25	7	4½
87	7½	132	4½	8
8	½	8		F.
701	ſq.	1059	ſq.	(12 36(3 Within.

Squares contained within the Body of the Ship Forward.

Example.

	F.	In.
Squares to 8 Foot	1230	4
Squares from 8 to 16 is	1047	4
Squares from 16 to 24 is	701	0
Squares from 24 to the Stem	186	0
Square feet in the body of the Ship Forward.	3164	8

Square Feet without the Body Forward.

Example.

	F.	In.
Square of 8 foot	529	8
Square from 8 to 16 foot	712	8
Squares from 16 to 24	1059	0
Squares to the end of the Stem	1134	0
Content without Forward by the Work.	3425	4

How to find the Square Feet within and without the Ship, from the Loof Aft to the Figure A.

Example. Proceed as you are Taught for Timbers from the Looſe Forward.

The extream breadth is 159 within, and 61 Foot without the Body.

To find the Contents from the *Frame* at the Loof to the Timber at 14 foot Aft.

Square in the Frame 14 Foot Aft.

In the Body. F.	F.		Without the Body. F.	In.
10	20	0	2	0
9	19	8	2	4
8	19	0	3	19
7	18	2	3	10
6	17	4	4	8
5	16	2	5	10
4	15	0	7	0
3	9	8	12	4
2	4	0	18	0
1	1	0	21	0
Sum	140	0	80	0 Square Feet.

Squares

Squares in the Frame 24 Foot Aft, from the Looſe within the Body and without.

F.	F.	In.	Without.
10	17	6	4 6 Squares.
9	17	0	5 0
8	16	0	6 0
7	15	0	7 0
6	13	6	8 6
5	11	2	10 10
4	7	0	15 0
3	5	0	17 0
2	2	0	20 0
1	1	0	21 0
Sum	105	2	of 114 10 ſquare F.

The Content of the Frame 34 Foot from the Looſe Aft.

In the Body F.	F.	In.	without the Body. F.	In.
10	13	6	8	08
9	12	2	9	10
8	10	2	14	10
7	8	0	15	0
6	6	3	15	9
5	4	8	17	4
4	3	6	18	6
3	2	0	20	0
2	1	6	20	6
1	1	0	21	0
Sum	62	9	of 157	3 ſquare F.

The Square Feet in the Timber 42 Foot from the Looſe Aft.

Square within. F.	F.	In.	Squares without. F.	In.
10	8	0	14	0 Squares.
9	6	0	16	0
8	4	4	17	8
7	3	8	18	4
6	3	2	18	10
5	2	6	19	6
4	2	2	19	10
3	1	10	20	2
2	1	5	20	7
1	1	0	21	0
Sum	34	1	of 185	11 Square.

To find the Square feet from the Frame 42, from the Loof to the Stern or end of the Ship aft 7 F.

Frame 42 is Foot	Inch.	
34	1	
17	½	half
17	½	
7		
119	3½	ſqu.

to the end within. ½ an Inch is ½ Inches add.

Foot.	In.	
185	11	ſquare.
34	1	
220	00	
17	½	
202	11½	
7		
1420	8 ½	ſq.

without with 11 ½ Inches Multiply'd by 7 is 6 foot 8 inches add.

The Squares contained from the Looſe to 14 foot aft, within and without the Ship.

Within. F.	In.		F.	In.	
159	00	main fr.	61	00	7 foot add to the ſquares within.
140	00	fr. 14	80	00	
19	00		19	00	7 foot add to the ſquares without.
9	6	half.	9	6	
149	6		70	6	
14			14		
603		ſq. feet	287		
149		within	70		
1093		the body	937		ſquares form without the Body.

The

The ſquare feet contained from the Frame 14 to the Frame 24, within the Body and without.

F.	In.
140	00
105	00
34	10
17	5
122	7
10	
1225	10

ſquare within the Body.

F.	In.
80	0
114	10
34	10
17	5
97	5
10	
974	2

ſq. F. without the Body.

Inch.	
7	
10	
12) 70	F. In. 5 10

add to the ſquare within the body.

Inch.	
5	
10	
12) 50	F. In. 4 2

The Square feee contained from the Frame 24 foot from the Looſe to the Frame 34 foot Aft.

F.	In.
105	00
62	9
42	5
21	$2\frac{1}{2}$
83	$11\frac{1}{2}$
10	
839	7

ſquare feet within.

F.	In.
114	10
157	3
42	5
21	$2\frac{1}{2}$
	$0\frac{1}{2}$
10	
1360	5

ſquare without the Body.

Inches.	
	$11\frac{1}{2}$
	10
12) 115	F. In. 9 7

add to the ſquare within

	$2\frac{1}{2}$
	10
12) 25	F. In. 2 1
	2

The

The Square feet from 34 to 42 foot Aft, within and without.

F.	In.
62	09
34	1
28	08
14	4
48	5
8	
387	4

ſquare feet within.

F.	In.
157	3
185	11
28	8
14	4
171	7
8	
1372	8

ſquare feet without

Inches.	
5	
8	
12) 40	F. In. 3 4

add to the ſq. feet within.

Inches.	
7	
8	
12) 56	F. In. 4 8

add to the ſq. feet without.

	F.	In.
Squares to 14 Foot	2093	0
Square Feet from 14 to 24 F. is	1225	10
Square F. from 24 to 34 is	839	7
Square F. from 34 to 42 is	387	0
Square Feet from 42 to the end Afteron, is	119	$3\frac{1}{2}$
Sum of F. in the Body of the Ship from the Looſ Aft	4664	$8\frac{1}{2}$

Square Feet contained without the Body of the Ship Aft, to compleat the Parallelogram or Oblong Square the Ship lyeth in.

	F.	In.
Square F. from the Looſe to Timber 14 Foot	0987	00
From 14 foot to 24 is	0974	02
From 24 foot to 34 is	1360	05
From 34 foot to 42 is	1372	08
From 42 foot to the end of the Ship Aft	1420	08
Sum of ſquare Feet	6114	

How to find the Burthen of this Ship in Tuns of 20 C. wt. to the Tun, at 10 Foot Draught of Water, Forward and Afteron.

Example. Add the Contents found in this Work of the Bulks Body forward, to the Contents of the Bulks Body aft together, this gives the ſquare Feet contained in the Body of the Ship within, thoſe Feet convert into Sums as you are taught in this Work, will give you the weight of the Ship, and all that is within her.

Example.

	F.	In.
The Contents Forward in ſquare Feet.	3164	8
The Content Aft	4664	$8\frac{1}{2}$
Square Feet Contained in the Ship	7829	$4\frac{1}{2}$

The

The Reduction into Tuns.

7829 $4\frac{1}{2}$ 7 Gallons — 7829 ſquare 3 Pint.

54803
3762 Gal. add.

252) 58565 (232 *Tun.*
50101
0608
4
C.wt.
112) 808 (70
24

I omit the 4 and a half In.

8) 234 87 (2936 $\frac{4}{8}$
724
8) 2919 (489 $\frac{7}{8}$
777
8) 1959 (245,0
350
8) 734 (91
1

Gallons 3762

The Content of the Ship is 232 Tun, 7 Cwt. 24 lb of Wine weight, accounting one Pound to a Pint, or rather Salt Water weigh 18 Cwt. as you are Taught in this Work, which you muſt reduce into Tuns of 20 C Averdupois.

Thus Multiply by 232 18 — 7 C. 24 lb

1166
232

20) 4183 (209 Tuns 3 C.
0 0

The Weight and Burthen of the Ship, and all that is in her at 10 foot Draught of Water Fore nd Aft.

How to find the weight of your Ship when ſhe is Lanched by her Draught of Water.

Example, Suppoſe your Ship, when ſhe is Lanched into the Water, draws 7 foot Water After on, and 4 foot Forward, her Weight is required. This you muſt work as you are Taught, for 10 foot, only a Regard had to your Water Line on the ſide, cut at the Looſe: To calculate the Content under to 4 foot and forward, above to 7 foot Aft, the Contents forward you muſt *Subſtract*, and the Contents Aft add.

How to find the Depth that the Water Line, toucheth the ſide at the Looſe.

Example. Suppoſe at the Lanching the Ship draw 6 foot 11 inches Afteron, and and 4 foot 1 inches forward, you muſt *Subſtract* the one from the other, the difference is 2 foot 10 inch. then ſay, if 79 f. yields 32 inches, what ſhall 30 foot the diſtance of the *Stem* to the Looſe yield the fourth number found added to 4 foot Draught of Water forward, gives the Draught of the Water Line at the Looſe.

	F.	In.
Example. The Draught of Water Aft.	6	11
The Draught of Water Forward.	4	1
difference.	2	10

Then if 79 foot gives 34 inches, what ſhall 30 foot give.

34
30
79 1020 (12 72
232
79 parts
which is near 13

	F.	In.
which added to the Draught.	4	0
add	1	1
The Draught of the Water Line at the Looſe from whence I take the *Square*.	5	1

How

How to find the ſquare Feet in the Bulks Body for 5 foot forward.

Example. To find the Square feet contain'd at the Looſe.

F.	F.	In.	F.	In.	
5	18	3	57	3	1 Inch
4	17	0	51	1	8
3	15	0			
2	6	0	6	2	8 Inch. add
1	1	0	3	0	
					F. In.
			54	1	by 8 is 432 8

in the looſe Frame.

Square 57 3

How to find the Square Feet at Timber 8 Foot.

F.	F.	In.	F.	In.	
5	17	0	51	1	$6\frac{1}{2}$ Inch.
4	15	9	28		$8^{\frac{1}{2}}$
3	12	4			F. In.
2	5	0	23	1	52 (4 4 *add*
1	1	0	11	$6\frac{1}{2}$	
					F. In.
			39	$6\frac{1}{2}$	by 8 is 316 4

in the *Frame* 8 foot.

Square 51 1

How to find the ſquare Feet at Timber 16 Foot.

F.	F.	In.	F.	In.	
5	11	8	28	8	10 Inch.
4	8	0	13	0	8
3	5	0			F. In
2	3	0	15	8	12 (80 (6 8
1	1	0	7	10	
					F. In.
			20	10	by 8 is 166 8

in the Frame 16 Foot.

Square 13 0

How to find the Square Feet at Timber 24 Foot.

F.	F.	In.	F.	In.	
5	4	8		6	F.
4	3	0		3	add.
3	2	4	10	3	*F. I.*
2	2	0		18	12) 18 (1,6
1	1	0	6	6	by 3 19 06

to the end of the Stem.

Square 13 0

How to find the Squares contained between 4 Foot Mark and 5 Foot from the looſe Forward, which muſt be Subſtracted from the Contents of ſquare Feet Forward.

Example. Work by the Rule of Proportion or Golden Rule. If 30 Foot the length from the Looſe to the Stem, give 12 Inches or 1 Foot, what ſhall 8 Foot give (the ſpace between the Looſe and the Timber at 8 Foot Forward) the Inches Multiplied by 8, yields the Square Feet from the Looſe to the Timber 8 Foot Forward.

To find the Content Forward, from the Looſe to Timber 8.

As 30 is to 12, ſo is 8 to a 4th number.

8
30) 96 ($3\frac{1}{5}$ Inches.
0
$\frac{5}{8}$

25 $\frac{1}{2}$ Inches the $\frac{1}{2}$ is 1 Foot $\frac{1}{4}$ for the Contents.

I *To*

To find the Content Forward, from Timber 8 to 16 Foot.

As 30 is to 12, ſo is 16 to a 4th number.

16
72
12

Inch. 30) 192 (6 12/30 Inches.
12

6 12/30 Subſtr. 3 6/10 there reſts 3 6/10 Inch. the 1/2 is 1 1/10 added to 3 Foot 6/30 is 4 24/30 Multiplied by 8 yields 38 Inches the Content between Timber 8 and 16, is 3 Foot and 2 Inches.

To find the Contents from Timber 16 to 24 Foot Forward.

As 30 is to 12, ſo is 24 to a 4th number.

24
48
24

30) 288 (9 18/30 Inches.
1

Subſtract 6 12/30 from 9 18/30, will be 3 6/30 Inches, the half 1 3/30 added gives 8 1/30 Inches, the mean Multipried by 8 gives the Contents between Timber 16 and 24, which is 5 Foot 5 Inches.

How to find the Contents from Timber 24 to the end of the Ship forward.

Example.

At the Timber 24 depth is 39 18/30 inches at the end 12 inches; Subſtract the one from the other; the difference is 2 12/30; the 1/5 thereof is 1 6/30 added to 9 18/30 inches is 10 24/30 inch, multiply by 6 foot. The length to the Stem yeilds 64 4/24 inches, which makes 5 foot 4 inches 4/24 parts; theſe all added makes 15 ſquare feet, the half of 30 foot.

Note, This is the Rule and Way of Proportion when the Water Line run from 5 foot draught of water forward to 4 foot at the Looſe on the ſide, and fall at 2 foot afteron, the Content forward muſt be ſubſtracted from the Content of the Bulks body, taken to 5 foot.

How to find the ſquare feet that the Water Line makes on the ſide from 4 foot draught of Water unto 5 foot at the Looſe, which you muſt Subſtract from the Contents of the Square forward.

Example. If 27 foot the length to the Looſ, give 12 inches, what ſhall 6 give from the Stem altho' it bears not 4 foot in leng. here, I keep the Proportion to come even with the other Timbers, to Timber 24 foot.

F. I. F.
As 27 to 12 ſo is 6 foot to a 4th number,
6

27) 72 (3 2/27 the one half is 1 6/30 multiply by 3 foot is 4 3/27 inches and parts for that ſpace. On the ſide of 3 foot the water Line makes on the ſide.

How to find the Contents, the water Line makes from Timber 24 to Timber 16.

Example. As 27 is to 12, ſo is 11 length from the Looſe to a 4th number

11
12
12

27) 132 (4 24/27 Content.
24

which

which 4 24/27 ſub. 3 3/27 is 1 21/27 with the half is 10/27 added to 3 3/27 is 3 13/27 inches; the Content of inches the Water Line makes between Timber 24 and 16 foot, 3 13/27 multiply by 8 is 30 2/27 inches which is 2 foot 6 2/27 inches Content.

How to find the Contents from Timber 16 to 8, that the Water Line maketh on the ſide.

F. In.
Example. As 27 is to 12, ſo is 19 foot to the Contents
19
108
12

27 228 (8 12/27 inches
12

from which 8 12/27 ſubſtract 4 24/27 there remains 3 15/27, whoſe half is 1 23/27 which added to 3 15/27 is 5 Content; multiply by 8 foot is 42 2/27 that is 3 foot 6 2/27 inches Content.

How to find the Contents from Timber 8 to the Looſe.

Example. The Looſe gives 12 inches, Subſtract 8 12/27 inches, the difference 3 15/27. The half is 1 21/27 added to 8 12/27 is 10 6/27 the Content from Timber 8 to the Looſe 10 6/27 mult. by 8 gives 81 18/27 parts, which is 6 foot 9 18/27 inches Contents.

How to find the Content in the Body that the Water Line makes from the former Work.

Example. Find the Contents of feet within the Body, and Multiply them by the Contents found, which Content Multiply by the Contents thorough in the Body gives the Contents, which Subſtract from the ſquare feet found in the Bulks Body, forward, give the Exact Content of your Ship forward from the Looſe.

How to find the Contents from the Looſe to Timber 8.

F.	F.	In.	F.	In	F.	In.	
5—	18	3 1/2	17—	7 1/2	17	0	17
4—	17	0	16	4 1/2	6	8 11/27	9
	1	3	1	3	102		12)153(12
		7 1/2		7 1/2	12	7	27
					1	1	add
Con.	17	7 1/2	17	00	115	8	17

115 F. 8 In. Cont. in the Body. 21

17
34

27)357(13
56

How to find the Contents from Timber eight to Timber ſixteen.

F.	F.	In.	F.	In.	F.		
5—	17	0	16	4 1/2	13	1 1/2	13
4—	15	9	9	10	3	6 16/27	10
	1	3	6	6 1/2	45	6	27)130(4
		7 1/2	3	3 1/2		3 1/2	22
						4 1/2	
con.	16	4 1/2	13	1 1/2			

46 2 1/2 Content.

46 foot 2 1/2 inches Content in the Body.

How to find the Contents from Timber 16 to Timber 24.

F.	F.	In.	F.	In.	F.	In.	
5—	11	8	9	10	6	10	
4—	8	0	3	10	2	6 13/27	mult.
	3	8	6	00	15	5	
	1	10	3	00	2	2	
cont.	9	10	6	10	17	6	Cont.

17 foot 6 inches content in the Body.

How to find the Contents from Timber 24 to the end, 30 foot here at 5 foot draught of Water.

F.	F.	In.	F.	In.	F.	In.
5—4	8		3	10	1	11
4—3	0					4½ inch.
	1	11				
	1	8	½ con.			7¾ inch.
		10				
con.	3	10				

7 inches and ¾ Content in the Body.

How to find the Square feet contained in the Body of the Ship from the Looſe forward.

Example. Add the Contents forward between Timber 8 and the Looſe together; then add the Contents found that the water Line maketh in the Body, and the aggregate Subſtract from the Contents found from the Looſe forward, the remaining Sums are the ſquare Feet of this Fore parts of the Ship.

The Square Feet from the Looſe.

	F.	In.
To Timber 8 are	432	8
From Timber 8 to 16 is	316	4
From Timber 16 to 24 is	166	8
From Timber 24 to the end	19	6
Aggregate	934	10

The Square Feet made in the Body by the Water Line from the Stem to Timber.

	F.	In.
24 Aft towards the Looſe	000	7¾
From 24 to 16 is	017	6
From 16 to 8 is	046	2½
From Timber 8 to the Looſe	115	8
Aggregate	180	0¼

	F.	In.
The Aggregate forward	934	00
The Aggregate by the Water Line Subſtract	180	00
Sum of Feet	754	00

754 Square Feet contained in the Ship from the Looſe forward.

How to find the Square Feet in the Bulks Body, for 5 Foot Draught of Water from the Looſe Aft.

Example. The Content of the Looſe Frame, found 57 Square Feet 3 Inches, and the Content 432 Square Feet and 8 Inches, I proceed to find the Square Feet from the Looſe to Timber 14, Aft.

F.	F.	In.	F.	In.	F.	In.	
5—	16	4	57	3	51	7½	14
4—	15	0	46	0	14	*Mult.*	7
3—	9	8					F.
2—	4	0	11	3	212	12)	105(8,
1—	1	0	5	7½	51		09
			51	7½	722	9	add the Content from the looſe to Tim. 14 Aft.

Sq. 46 0

How to find the Square Feet from Timber 14 to Timber 24.

Example.

F.	F.	In.	F.	In.
5—	11	2	46	0
4—	7	0	26	2
3—	5	0		
2—	2	0	19	10
1—	1	0	9	10
			36	0
			10	Multiply
			360	Content in Feet.

Sq. 26,2

How to find the Square Feet from Timber 24 to 34.

F.	In.	In.	F.	In.	
5—4	8	26	2	11	Inch.
4—2	6	11	8	40	
3—2	0				(F. Inch.
2—1	6	14	6	12)510	(9 2 add
1—1	0	7	3	02	
		18	11		
		10		Multiply.	
		189	2	Content in Feet.	

Sq. 11 8

How to find the Square Feet from Timber 34 Foot, to Timber 42 Foot.

Example,

F.	F.	In.	F.	In.	
5—	2	6	11	8	3½ Inch.
4—	2	2	8	11	8
3—	1	10			12)28(F. Inch-
2—	1	5	02	9	2 4 add.
1—	1	0	1	4½	
			10	3½	
			8	Multiply	
			82	4	Content in Feet.

Sq, 8 11

How to find the Square Feet from Timber 42 Foot to the end Aft.

F.	In.	
8	11	
4	5½	
7	Multiply	
51	2	Content to the end or Stern of the Ship.

How to find the Contents that the Water Line maketh on the ſide, from the Looſe to the Frame 14 Foot Aft.

Example, Proceed by the ſame Rule as you are Taught in the former Work Forward, as 49 Feet, the Length from the Looſ to the Stern is to 24 Inch, or 2 Foot, that the Water goeth from the Looſe to 7 Foot Draught of Water Aft, ſo is 14 to the difference the Water Line maketh on the ſide for 14 Foot, which ſhall be the Content.

As 49 is to 24 ſo is 14 to a 4th numb.

14

96

24

49) 336 (6 42/49 Inches, Parts.

42

one half is 3 41/49 Inches Multiplied by 14 is 44 Inch 42/49 Parts of an Inch is 3 ſquare Feet 8 Inches 42/49 parts of an Inch, or ½, that the Water Line makes from the Looſe to Timber 14 Foot on the ſide.

How to find the Contents from Timber 14 to Timber 24 Aft.

As 49 is to 24 ſo is 24 to a 4th numb.

24

96

48

49) 576 (11 37/49 Inch. Parts.

037

from which 11 37/49 Inches Parts, Subſtract 6 43/49 the difference 4 14/49, whoſe half is 2 33/49 add to 6 43/49, is 9 11/14 Inches and Parts Multiplied by 10 is 93 Inches, or 7, foot 9 Inches for the Contents on the ſide made by the Water Line.

How

How to find the Contents from Timber 24 to Timber 34 Aft.

As 49 is to 24 so is 34 to a 4th number.

34
96
72
49)816(16 $\frac{32}{49}$ Inches Parts.
22
3

which 16 $\frac{32}{49}$ Substract 11 $\frac{17}{49}$ Inches and Parts is 4 $\frac{15}{49}$ Inches Parts, the one half is 2 $\frac{15}{98}$ added to 11 $\frac{17}{49}$ is 14 $\frac{1}{98}$ Inches Content on the side made by Multiplying it by 10 is 142 $\frac{3}{49}$ Inches and Parts, or 11 Foot 10 $\frac{3}{49}$ Inches and Parts the Content.

How to find the Contents from Timber 34 Foot to Timber 42 Foot.

As 49 is to 24 to is 42 to a 4th number

42
48
96
49)1008(20 $\frac{28}{49}$ Inches and Parts.
02

from which 20 $\frac{28}{49}$ Substract 16 $\frac{32}{49}$, the difference is 3 $\frac{45}{49}$, the one half is near 2, added to 16 $\frac{32}{49}$, is 18$\frac{1}{49}$ Multiplied by 8 yields 145 Inches, or 12 Feet 1 Inch the Contents.

How to find the Content from Timber 42 Foot to the end Aft.

From 24 Inches Substract 20 $\frac{28}{49}$, the difference is 3 $\frac{21}{49}$ Inches and parts, the $\frac{1}{2}$ thereof is 1 $\frac{35}{49}$ add to 20 $\frac{28}{49}$ is 22 $\frac{14}{49}$ In. and parts, Multiplied by 7 is 156 Inches, or 13 Foot, the Contents to the end.

How to find the Contents that the Water line makes on the side and the Contents made in the Bulk Body.

Example.

From the Loofe Aft to Timber 14 foot the Content of the Ship from 5 Foot to 6 Foot in the Body, and Multiply it by the Contents, the Water Line makes on the side.

F. F.	In.	F.	In.	
6—19	0	8	9½	17
5—18	3	16	9	8
0	9	1	10	12)136(F. In.
	4½		11½	11 4
Sq. 18	7½	17	8½	8½
		3	8 Mult.	through 3
				is 25½

53 6 Inches.
the Content thro' the Body.

How to find the Contents from Timber 14 to Timber 24.

F. F.	In.	F.	In.	
6—17	4	16	9	14 Inch.
5—16	2	12	4	9
1	2	4	5	12 126(F. In.
	7	2	2½	0 (10 6 add.
Sq. 16	9	14	6½	6½
		7	9 Mult.	7
				12)45½(F. In.
				3 9½ add.

112 9 Contents.

How

How to find the Contents from Timber 24 to 34.

F. F.	In.	F.	In.	
6—13	6	12	4	9 10 Feet.
5—11	2	5	5	11 10
2	4	6	11	116 00 Contents.
1	2	3	5½	Water Line make.
Sq. 12	4	8	10½	I allow 1 Foot for 6
		1	00	and 7 Foot.
		9	10½	

How to find the Contents from Timber 34 Foot to Timber 42 Foot.

F. F.	In.		F. In.
6—6	3	5 5½	05 5½ Feet.
5—4	8		12 1
1	7	3 3	65 7 Content.
	9½		Water Line
		2 0½	I allow 1 Foot for
Sq. 5	5½	1 0½	6 and 7 Foot, and
			spare the Working.
		4 5½	
		1	
		5 5½	

How to find the Contents from Timber 42 to the end within the Body.

Example.

6—3	8	4	0
5—3	2	half	
		2	0
	0	6	
		3	
Sq. 3	5		
	0	7	Allowed for the difference between the 6 and 7 foot Draught of Water, and omit the Water.
	4	0	

13 Foot.
2 Mult.
26 Foot the Contents.

How to find the Squares contained in the Body of the Ship from the Loofe Aft.

To follow the *Example* of your directions you have in the Work Forward.

	F.	In.
The Square Feet from the Loofe to Timber 14 Feet	722	9
From Timber 14 to 24 is	360	0
From Timber 24 to 34 is	189	2
From Timber 34 to 42 is	82	4
From 42 to the end	31	2
Sum Contents	1385	5
Add the Feet by Water mark to 14 Foot from the Loofe	53	6½
From 14 to 24 add	112	8
From 24 Foot to 34 is	116	0
From 34 to 42 Foot is	65	7
From 42 Foot to the end	26	0
The Content of the Body from the Loofe Aft.	1759	2
The Square of the Ship forward	754	0
Sum	2513	2

2513 Square Feet was the Contents of the Ship when she was Launched into the River.

How

How to bring theſe Square Feet into Tuns.

Example, 2513 Square Feet, it is required the Tuns contained therein.

2513 Feet. 7 — 17591 — 1207

112) 18798 (8
112) 1503 87 (Cwt
0936 705 (1343
0462
00
20) 1342 (67, 2
142

2513 sq. Feet. 3 *Gal. P.*
8) 7539 (942 4 *Gall. P.*
8) 1256 (157 7 *Gal. P.*
45
8) 228 (73 4
04
8) 235 (29 3
23
Gal. 1201 0

The Weight of the Ship at Lanching.

Note, 37 ſquare Foot, and a half is a Tun.

How to find the Weight of your Maſt Yards, Anchors, Cables and Guns one Board, and all your materials.

Example. If your Ship will bear her ſelf, add the Contents of the draught ſhe draws more than ſhe did at Lanching, to her weight found, which gives the weight of both Ship and Materials. Otherwiſe *Note* what Ballaſt you take Aboard from the place you Ballaſt at, and 14 C. to the Tun if at *London*; in other places let your Eſtemiare be Accounted according to the beſt of your Judgment. Then when you are Compleatly Rigg'd, take the difference of your draught of Water and reduce into Tuns, deducting the Ballaſt taken Aboard, and the remainer added to the weight of the Ship, is the weight of the Ship, with her Maſt and all her Materials.

How to find what Tunnage this Ship will Burthen at 20 C. wt. to the Tun, at 10 Foot draught of Water Fore and Aft.

Example. The Tunnage of the Ship, is found to be 209 Tuns 3 C. Subſtract the weight of the Ship and Materials (by reaſon we omit the Work for the Weight of the Material) as the Maſt Sails Rigging, which is commonly rekoned ¼ of the weight of the Ship with her Guns, which is 22 Tuns, and will be near the matter added to the weight of the Ship at Lanching, and produceth the weight of the Ship and all her Furniture. This Sum Subſtracted from 209 Tuns 3 C. wt. gives the weight of the Ship in Tunnage.

Example.

	T. C.wt.
Burthen to 10 Foot Water	209 3
	T. C.wt.
Weight Ship	67 3
Weight Maſt and Materials	22 0
Weight both	89 3
The Ship Maſt Sailes Anchors Cables, Guns and all other Materials Subſtract	89 3
The Burthen of this dimention at 10 Foot draught of Water Fore and Aft.	120 0

How to find the Tunnage from 10 Foot draught of Water Forward, to 11 ½ Foot draught of Water Aft.

Example. I ſuppoſe this Ship will Swim at this draught of Water when ſhe is Laden, and will be Jocund. So I ſhall give the General Heads from the Rule.

How

	Ft.	In.
From the Stem to Timber 24 Foot	002	08
From 24 Foot to 16 is	020	8
From 16 Foot to 8 is	056	0
From 8 Foot to the Looſe	089	0
From the Looſe to 14 is	179	10
From 14 to 24 Aft is	176	4
From 24 Aft to 34	186	4
From 34 to 42 is	088	8
From 42 to the end is	042	6
Square Feet	842	0

Sq. 842
7 Gal.
5894
390
6284
8
112) 50272 (C.wt.
05494 (448
099
0
20 (448 (22 Tuns.
C.wt. (
8 to add.

842 ſqu. Feet.
3 *Gal. Pints*
8) 2426 (203 2
002 (
8) 421 (52 7
77
8) 215 (26 7
5
8) 80 (10 0
0
399 0
Gallon add.

	Tuns	C.wt.
The Burthen of the Ship found at 10 Foot	120	00
The Tunnage, from 10 Foot Water forward to 11 ½ Foot Aft, as above is found.	22	8
Ships Burthen,	142	8

After this manner you may Work any Dimenſions whatſoever, and if the Contents of feet in the Body be exactly gained, you will fall little ſhort of the Weight of your Ship at her Lanching, and of her Materials and Burthen, after all to any Draught of Water; and by your Rule preſcribed you may know what Tuns of 20 C.wt. to the Tun you take Aboard, of any Ship whatſoever: Noting that you muſt have the Dimenſion of at leaſt 4 of her Moulds Forward, and 4 Aft, as exact as you can get them.

At the Building of any new Ship the Contents of theſe Frame Timbers noted down will be ſufficient for the compleat finding your Burthen at all Draughts of Water, as likewiſe how to place your Maſt, and what Draught of Water your Ship ought to go at, for the beſt of her Sailing: As likewiſe, you will find the difference between this and the common Rule given, by Multiplying the Length by the Breadth, and that Product by the Depth, or half Breadth; that Product divided by the given number 100, and by 94, for Merchants Tunnage, this comes not near the Truth. I knew two Ships, of equal Length, and Breadth and Depth, and the one was but 100 Tuns, the other was 120 Tun, ſo much was the difference of their Bulks in their Bodies, the one being a Broad Stern, and the greater Burthen a round Stern. *Note*, There are 113 ſquare feet and one half in three Tuns: So if you Multiply the Length of your Ship, from her Stem to her Stern, at the height of her Depth in the Hold, by her Breadth, and the Product Multiplied by the Depth, the laſt Product being divided by 114, ſhall come nearer the Truth, then the given Number 100, or 94, which 14 Feet are cut off from 114, to Anſwer the irregular Frames of the Body of a Ship, as likewiſe to anſwer the Rake Forward and Aft; the Rake Forward may be accounted Burthen taking the half of it, and will meaſure near what the other Length of the Keel doth, for Proof you may proceed, and find what Burthen the Length of the Keel, Multiplied by the Breadth of the Beam, the Product by the Depth, and that divided by 100 or 96. Then the

the ſame Dimenſion Multiplied by the Breadth, and half the Breadth and Note it. Then again by the Length of the Keel, by adding half the Rake, and ſomewhat leſs: Than at laſt, by the former Direction, and Divide the Product by 114. Then by the General Work, finding the Contents of the Ship, which is the moſt Exact, and the Difference will appear, and you will find the laſt Directions by the General Work, to be neareſt the Truth, when exactly wrought, and as it may be handled, will tell you how far you may Lade your Ship to come ſafe thro' the Sea; and indeed it is of great uſe, for whatever can be required from any Ship, or demanded.

The Deſcription how to hang a Riſing Line by ſeveral Sweepes, which ſhall be Rounder Aſt than at the beginning.

Example.

DRaw the Line D E (as in the next figure) which ſhall Repreſent the length of the Riſing Line, ſet thereon 20 foot from D to E, at E erect a Perpenpicular and ſet 6 foot thereon to I, which is the height of your Riſing Line. It is required to find the Tangent that ſweepeth the Arch from D to I, at D Raiſe a Perpendicular, and draw a Line from D to Q on the Line D Q, at Q ſweep your Arch from D to I, and that Extent of your Compaſs by the Scale of Feet, will be found to be 36 Foot 4 Inches, the length of your Tangent Line.

How to prove this by the Table of Squares.

Example. Convert 6 Foot, the height of your Riſing from E to I, into Inches is 72 Inches, then 20 Foot the length of your Riſing Line from D to E into inches, which is 240 inches, ſquared is 57600, divided by 72, the Quotient is 800, to which add 72; the Aggregate is 872, the one half thereof is 436 inches, which brought into feet and inches is 36 foot 4 inches, the length of the Tangent that ſweepeth the Arch that riſeth to 6 foot as above.

How to Round an Arch from any part of this Arch to what Rounding you pleaſe.

Example. At 12 foot length of the riſing Line from the point D, I would Round an Arch from the point C to the point F, which is 10 foot, ſet of 12 foot from D to C, and at C raiſe a Perpendicular and draw a Line, and where that Line cuts the back of the Arch D I in the point B, there you muſt begin to Round your Arch from B to *F*, then from K to M draw a Line parallel to E D through the point *B*.

How to find the Riſing at the point C by the Table of Squares.

Example. 12 foot on the length of the Riſing Line from D to C, I would Round a Line from the point B to *F*, apply to the Table of Squares, there take the Square of 12 foot 20736, and the Tangent Q B 36 foot 4 inches; the ſquare thereof is 199600, Subſtract 20736, the ſquare of the other ſide, there reſts 169360, whoſe Root is 34 foot 3 inches and ½, which being Subſtracted from 36 foot 4 inches, leaves 2 foot, and half an inch giving the Riſing at the point C

How

How to find the Rounding from B to F.

Example. Draw a ſtreight Line from B to F, which makes a Right Angle Tryangle of the ſide B M. The Tangent of this Sweep, and the ſide M *F*, the height of the ſame, together with the ſide B *F*, a Line drawn from the middle of the ſide B F to the center at M, till it cut the Line D Q, there is the center of the Tangent that ſweepeth this Rounding Arch, as the Line G M, paſſing the middle of the Line B *F*, at the point O to G which is 22 foot 4 inches required.

How to find the Tangent that Sweepeth the Round Arch by the Tables of Squares.

Example. The length of the ſide B F you are to find, having the ſide B M 8 foot, whoſe Square is 9226, and the ſide M F 8 foot neareſt, whoſe ſquare is 9226 added, makes 18452, the Root is 11 foot 4 inches, the one half is 5 foot 8 inches, it being the middle of the Line B F, from the point M, through O cut Q D in G, by a Line drawn as aforeſaid in the Geometrical Figure; here *F* O and B O are equal, in other Arches it may fall otherwiſe O M 5 foot 6 inches, and F M is 4 foot, and the ſide K M 20 foot.

How to find the ſide G M by the Golden Rule.

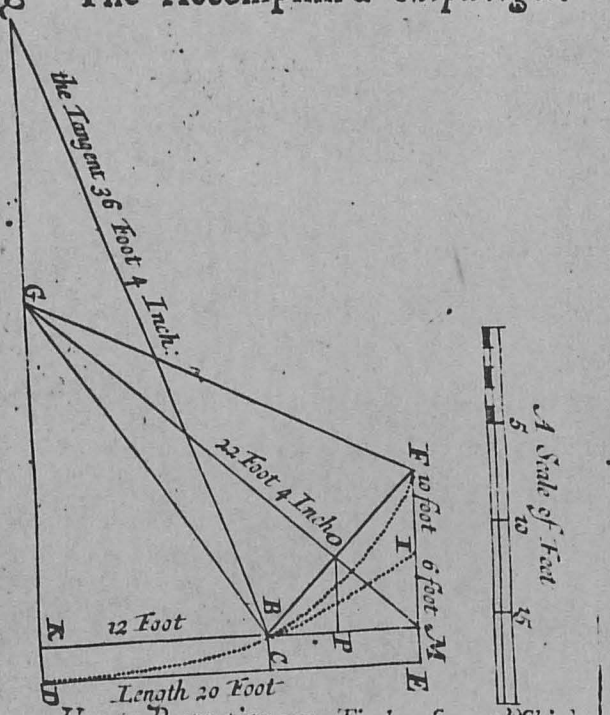
If P M 48 inches gives O M 66 inches, what ſhall K M 240 give? The 4th number is 330, for the ſide G M———Again the ſide G M 330 and K M 240, being found will find the ſide G K.

How to find the ſide G K.

Example. The Square of the ſide G M 330 inches or 27 ½ foot, the ſquare thereof is 108900, and the ſide K M 240 inches or 20 foot, whoſe ſquare is in the Table of ſquares 57600, Subſtract the remaining difference is 51350, the Root thereof is 18 foot 10 inches and ½ add thereto 2 foot and ½ an inch; the riſing makes 20 foot 11 inches which is the length of the ſide K G, which G is the Center of the Round Circle.

How to find the ſide G B by the Table of Squares.

Example. The ſide G K before found 18 foot, 11 inches, and K B 12 foot to find the ſide G B; the ſquare of G K 51300, ſquare of K B, 20936 added is 72036, the ſquare Root is 22 feet 5 inches; thus you may round your ſweep as often as you pleaſe. In this work you may uſe the Table of Logarithms. Theſe Tables of ſquares are plain and eaſie, although you may be more quicker with the Logarithms.



How to Proportion your Timber for any Ship.

The Scantling of the Navel Timbers, Futtocks and top Timbers, have their proportion from the bigneſs of the *Floor* Timbers, the thickneſs of the Plank according to the Burthen of the Ship, or as you ſhall deſign here for Strength, or according to whate Trade you deſign her for. Theſe Timbers muſt be allowed a Cubical proportion from a ſmall Ship to a greater, which requires Judgment.

Example. Suppoſe a Ship be 62 foot in length, on the Keel, in breadth 23 foot, and 10 foot depth in the Hold, and 16 foot Rake forward, and 2 foot Aft, 4 foot and ½ in depth between Decks at the Main-Maſt, 3 foot 4 inches waſte, the Stern Poſt 2 *Foot* in breadth, placed on the Keel with 12 *Inches* falſe *Stern* Poſt: The proportion for the *Scantlings* will run as followeth, if you Build for Strength; if for Sailing, let all of them be ¼ leſs, if for a Runner in Merchant Service ⅓ if you Build for a Privateer, let them be in proportion juſt to hold your Ship to be as ſtrong as poſſible for ſuch *Scantlings.*

Here followeth the Proportion for ſuch a Dimenſion for Strength.

Example. Let your Keel with a falſe Keel be 14 *Inches* in depth in the Midſhips, and 8 *Inches* in breadth, the *Floor* Timber 12 Inches up and down, and 11 Inches through, with

with 10 or 11 *Inches* Room from Timber to Timber, and 9 Inches at the Floor Timber heads wrought. Let your Navel Timber be 8 or 9 Inches in breadth, 10 or 11 *Foot* in length. Let your *Futtocks* reſt on your Floor Timber heads, ſo that here at the Round heads let your Timber chock cloſe *Fore* and Aft, this being the Principal part of the Ship that requires to be made Strong; being the general place of moſt Ships Complaining, let there be a good Kelſy from *Stem* to Stern, your Plank thicker by 1 *Inch* or ¼ an *Inch* at leaſt here, than your Plank you Build your *Ship* with in her *Body*, and let there be 3 or 4 Strakes of ſuch Plank at the Floar Timber heads up and down; here your Ship takes the Ground, let her have 9 double bound Beams, 12 Inches through, and 10 Inches up and down, let them round ½ an Inch to a Foot or leſs, let them be 6 Foot aſſunder, let your clamps Hook and But that you lay your Beams on, let there be 5 Breaſthooks forward, one placed for a ſtep for your fore-Maſt, which may be called a Rider, if your fore Maſt ſtand much Aft; this Dimenſion requires 3 Inch Plank for the outſide, one ſtrake above the upper Beam, and 2 inch or 2 Inch & ½ for the Seiling within, let your Decks be laid with good Spruce of 2 Inches from the *Saw*, if 2 ½ Inches it will Calk the better, Decks were and grow thinner. Be ſure to lay an Oaken Plank for your Water way to the ſide. The heigth and length of the Forecaſtle and Steerage as you pleaſe, let your Horſepieces be of the beſt Oak, your windle Cheeks, windle, and Cat Heads be ſtrong and good, let your Bends be 7 Inches up and down, 6 Inches in and out, and of as great a length as they can be wrought; let your Channel ben be 7 inches up and down, and 5 inches in and out; let all your work above your upper Deck be as light as poſſible. Thus you may Proportion any Ship as you intend for Strength, by Augmenting to, or leſſening theſe Proportions, or any Proportion you will begin with, for any Burthen whatſoever.

Direction how to Build a Ship for Saying.

Example. The *Dolphin*, the *Salmond*, or the *Mackerel*, biſſected, and their ture Proportions taken with all their Elipſis, truly Squared and Cubed, and their Area known, are the true Molds for a Sayling *Ship*, taking them in their length, breadths and depth, carrying their Proportions equally to the Burthen of the Ship you deſign to Build. This exactly performed, will appear to be the beſt of Molds to make a *Sayling Ship*; here Burthen cannot be expected, ſo that ſuch a Ship will ſerve only for a Man of War, or Cruizer.

A Ship Built for the Merchant Service, may be advanced ſo far in *Sayling*, that a Proportion beyond this, carry'd truly on, may be allowed to gain ſome Burthen to maintain her Charge, as may render her capable of eſcaping her Enemy in the Ocean. Should I enter on this Subject, it would be a Volumn of it ſelf ſo only hinted to you by the way. Suppoſe the *Dolphin* to be the ſwifteſt *Swimming* Fiſh, as ſome Men judge on the Account of her chaſing the flying Fiſh, and of the great Strength ſhe hath when ſhe is caught and out of her Element, or be the *Salmon* that is ſo ſtrong in her ſwift *Swimming* which will Leap 4 or 5 foot out of the Water with his whole Body, and doth *Swim* againſt the ſtrongeſt *Stream* or fall of water whatſoever. Be it a *Mackerel*, by ſome ſuppos'd to be a prey to no Fiſh whatſoever, when Chaſſed, which Fiſh will take the Bait at the ſwifteſt rate any *Ship* can *Sail*, at which time they often run themſelves off the Hook, by their ſwiftneſs, notwithſtanding the quick motion of Hauling, and motion of the *Ship*, and ſo Eſcape. The *Porpus* hath a ſwift motion in and towards Winds or Gales, more eſpecially in brisk *Sayling* wind at *Sea*. I ſhall not contend which of theſe Fiſh are the ſwifteſt, by reaſon any of theſe Nominated will allow ſuch a Model or Mold, as will allow any greater *Body*, in Proportion to paſs in the Element, the Water, their Element, with the leaſt ſtop in paſſing

paſſing Forward, or hindrance in the After parr, to ſtop its motion that can be, conſidering what ſuch a body will require, that ſtop muſt be, according to its greatneſs and magnitude; theſe Fiſh, their greateſt breadth is near the thirds of their length from the Tail to the Noſe, that is to ſay, the extream part of the bigneſs of theſe Fiſh, lieth of its length from her Noſe towards the Tail, or near $\frac{2}{3}$ from the Tail towards the Noſe, the *Dolphins* extream breadth and depth, is a ſmall proportion before the thirds.; the *Mackarel* is behind the thirds——— Either of theſe Fiſh, cut open on the top of the Back from the Noſe to the Tail, and let fall to the depth of 10 or 11 parts, the common depth of greater Bodies, will give a Delightful Mould and Shape, and much will appear to ſatisfie you that the nearer theſe Moulds you come for the Building any Ship for Sailing only, they be brought, and comes to the ſhape of any of theſe Fiſh, with thoſe Allowance needful, proportioned acordingly, it will gain the Sailing part, and in time it will come to a higher degree than ever yet it hath attained.

Here followeth the ſeveral Proportions for Maſting and Yarding of Ships.

The firſt thing muſt be to find the length of the Main-Maſt, by which all the other Maſt and Yards are proportioned.

Note, There are 4 ſeveral ways made uſe of for finding the length of the Main-Maſt, all which differ a ſmall matter in the Accounts thereof; my method is to take the Medium between them, as I have done in the following Performanec.

Example. The firſt proportion for the length of the Main-Maſt is $\frac{8}{9}$ of the Keel.

The ſecond Proportion is 3 times the breadth of the Beam, if your breadth doth not exceed 20 Foot, if it doth this Rule is of no uſe.

The third proportion is $\frac{1}{3}$ of the length of the Keel proper, 64 Foot, added to the breadth of the Beam.

The fourth, is the breadth and half breadth of the Ship added to the length of the Keel $\frac{1}{4}$ of that Product, is the length of the Main-Maſt in Yardes.

Example. Suppoſe a Ship according to the Model and Dimenſions laid down, Chapter the Third, Page 46. Where the breadth of the Beam is 22 Foot, the length of the Keel 64 Foot, and 6 Foot, at one *Foot* raiſe Accounted Keel is 70 Foot.

	F. In.
By the firſt Proportion $\frac{8}{9}$ of 70 Foot Main-Maſt is	62 2
By ſecond Main-Maſt the breadth is paſt the Rule	00 0
By the third Proportion the Main-Maſt is	64 8
By the fourth Proportion the Main-Maſt is	63 0
The Medium I allow the Main-Maſt	62 6

How to find the length of the other Maſts and Yards, by the Main Maſt.

Example. the Main Maſt allowed to be 63 Foot in length, the proportion $\frac{8}{9}$th of the the Main Maſt, is the length of the Fore-Maſt, the Boltſprit the length of the Fore

Fore Maſt, from the Forecaſtle Deck, the Mizen Maſt $\frac{3}{4}$, the length of the Fore Maſt. The Maintopmaſt hath 3 Proportions with the Main-Maſt, *Firſt* it is $\frac{1}{2}$ the length of the Main Maſt, for the length of the Maintopmaſt; the *Second* Proportion is $\frac{3}{5}$; the *Third* is $\frac{5}{8}$ths of the Main maſt, for the length of the Maintop-maſt; the Maintop-gallantmaſt $\frac{1}{2}$ the length of the Maintopmaſt, or $\frac{3}{10}$th of the length of the Main Maſt, the *Foretopmaſt*, and *Foretopgallantmaſt* bearing the ſame Proportion with the *Fore*-Maſt, the Mizen Maſt bears a Proportion of the length of the Maintopmaſt from the Quarter Deck, the Mizen topmaſt $\frac{5}{6}$ of the Mizen-Maſt; Spritſail topmaſt $\frac{1}{2}$ the length the Boltſprit, theſe being their Proportions, their Length are required.

To find the length of the *Fore* Maſt, the Main Maſt beng 63 foot, $\frac{8}{9}$ of 63 *Foot*, is the length of the *Fore* Maſt, by adding the Depth in the Hold.

63 Foot
8

Foremaſt at the Head 4 or 5 foot ſhorter than the Main Maſt, ſo you muſt add.

9)504(56
5

Foot, the length of the Foremaſt, which you muſt regard in ſtepping, and allow as it ſtands Forward or Aft in the Hold, ſo that 58 foot, is the length of the *Foremaſt* Cut.

To find the Length of the Boltſprit.

The Boltſprit is the length of the *Fore* Maſt from the Forecaſtle Deck, taking 10 foot from it, the Deck is 46 foot, the length of the Boltſprit; the ſecond Proportion is $\frac{2}{3}$ of the Main Maſt 63 foot is 42 foot, the Medium is 44 foot, the length of the Boltſprit.

To find the length of the Mizen Maſt.

The Mizen Maſt $\frac{3}{4}$ of the length of the Foremaſt 56 foot is 42 foot. The length of the Main topmaſt 37 foot, from the Deck, and 8 foot added into the Hold, is 45 foot the Medium, 43 foot 6 Inches, the length of the Mizen Maſt.

How to find the length of the Maintopmaſt, and Maintopgallant Maſt.

	F. In.
Main Maſt 63 foot, 1 Rule is half the Length, is	31 6
Second Rule $\frac{2}{3}$ of 63 foot: 3)126(42 foot length 00	42 0
$\frac{5}{8}$ Main Maſt 63 foot the third Rule. the length is	35 0
the Medium is the length of the Maintopmaſt.	37 0

How to find the length of the Maintopgallant Maſt

	F. In.
One half, the length of the Maintopmaſt	18 6
ſecond Proportion $\frac{3}{5}$ of 63 the length of the Mainmaſt	14 0
the Medium, the length of the Maintopgallantmaſt	16 3

How

How to find the length of the Foretopmaſt and Topgallantmaſt.

	F.	In.
Foremaſt 58 foot $\frac{1}{2}$ is the length of the Foretopmaſt	27	03
ſecond Rule $\frac{2}{3}$ of 58 is the length of the Foretopmaſt	39	4
third Rule $\frac{5}{5}$ of the Formaſt, the length of the Foretopmaſt	32	
the Medium is the Length I allow the Foretopmaſt	33	0

How to find the Length of the Foretopgallantmaſt.

	F.	In.
One half is the length of the Foretopmaſt, is	16	5
ſecond Rule $\frac{2}{3}$ length of the topmaſt is	13	3
the Medium is the length of the Foretopgallantmaſt	14	9

How to find the length of the Mizentopmaſt.

	F.	In.
Example. $\frac{5}{9}$ of the length of the Mizen Maſt from the Deck, is the Length of the Mizen Topmaſt.	20	00

How to find the Length of the Spritſailtopmaſt.

	F.	In.
Example. $\frac{1}{3}$ the length of the Boltſprit being 43 ſoot 6 inches, is the length of the Spritſail topmaſt, and is	14	6

How to find length of the Yards, in their Proportion, bearing their Proportion with the Main-Yard, and one with the other Main-Yard, Declining its Proportion from the Main-Maſt.

Example. The length of the Main-Yard by 3 proportions, bearing with the Main Maſt, *I* take the medium Main *Maſt*, 63 *Foot.*

	F.	In.
The fitſt Proportion $\frac{3}{5}$ and $\frac{1}{12}$ of 63 *Foot*, the length of the *Main* Yard is found.	47	03
The ſecond Proportion $\frac{8}{7}$ of 63 *Foot* length *Main Maſt*, is the length the *Main* Yard by this Proportion.	54	0
The thirp Proportion $\frac{2}{3}$ and $\frac{1}{6}$ of *Main Maſt* is	50	0
The medium *I* allow the *Main* Yards to be 50 *Foot* 7 Inche and $\frac{1}{2}$.	50	5

How to find the length of your Fore Yard.

Example. $\frac{6}{7}$ of the length of the *Main* Yard is the length of the Fore Yard, the *Main* Yard is allowed to be 50 Foot 7 Inches and $\frac{1}{2}$, the $\frac{6}{7}$ thereof is 43 Foot 5 Inches, is the length of the Fore Yard.

How

How to find the length of the Mizen Yard.

Example. The Mizen Yards is reckoned the length of the Fore Yard, which is 43 Foot 5 Inches; and by ſome the Medium between the Main Yard and Fore Yard, which is 46 Foot and a half.

How to find the length of the Maintopſail Yard.

	F.	In.
Example. $\frac{1}{2}$ the Main Yard is the length of the Main Topſail Yard. This is the firſt Proportion.	25	3
Second Proportion, is $\frac{2}{3}$ of the length of the Main Yard, for the length of the Maintopſail Yard.	33	6
Third Proportion is $\frac{4}{7}$ of 50, and 7 Inches.	30	0
(The Main-yaid) for the Maintopſail Yard, the Medium is the allow'd Length of the Maintopſail-yard.	29	9

How to find the length of the Foretopmaſt Yard.

	F.	In.
Example. The Firſt Proportion, is $\frac{1}{2}$ the length of the Fore Yard being 43 Foot and 5 Inches, which is	21	08
The Second Proportion is $\frac{2}{3}$ of 43 Foot 5 Inches, the length of the Fore Maſt	28	08
The third Proportion is $\frac{4}{7}$, of the length of the Fore Maſt	24	8
The Medium between theſe Proportions is the length of the Foretopſail Yard, which is	25	00

How to find the length of the Spritſail Yard.

	F.	In.
Example. The firſt Proportion is $\frac{5}{8}$ of the length of the Main Yard, which is 50 Foot 5 Inches for the length of the Spritſail Yard.	31	7
The Second Proportion, the length of the maintopſail Yard, is the length of the Spritſail Yard, I allow 2 Foot more, ſo that	31	0
the length of the Spritſail Yard is	33	7

Note, the Crojack Yard is always the length of the Main-Topſail, or Spritſail-Yard, which is 31 or 33 Foot, which you pleaſe.

Mizen-topſail-Yard is $\frac{1}{2}$ the Crojack, or $\frac{1}{3}$ of the Main Yard, which is 15 Foot and $\frac{1}{2}$ for the length; the Spritſail Topſail Yard, and Crojack, are equal, or $\frac{1}{2}$ the Spritſail-Yard for the Spritſail-topſail-yard, which is 16 Foot and $\frac{1}{2}$.

How to find the length of the Main-topgallant-yard.

Example. The proportion is $\frac{6}{17}$ of the Main yard, which is 17. Foot 1

10 Inches, or $\frac{1}{2}$ the length of the Main-topſail-yard, which is 5 Foot 6 Inches. The Medium is 16 Foot 8 Inches, but *I* allow 17 Foot for the length of this Yard.

How to find the length of the Foretopgallant-yard.

Example. The Fore-yard is 43 Foot. The firſt Proportion is $\frac{6}{17}$ of this length, which is 15 Foot for this Yards length. A ſecond Proportion is $\frac{1}{2}$ the length of the Foretop-ſail-yard, which is 25 Foot, the $\frac{1}{2}$ is 12 Foot 6 Inches, the Medium is 13 Foot 3 Inches, for the Foretopgallant-yard.

Note, There ought to be a regard to the Condition and Nature of the Ship, as to ſtiffneſs and bearing, ſo allow, according to your Judgment, a Foot or 2 of Maſt, or take from your low Maſt, a Foot or 2; likewiſe, the depth of your Ship is to be conſidered in their length, and the ſtepping of your Maſt according as your Mizen-maſt and Fore-maſt ſtand in height in the Hold.

How to find the Circumference and Diameter of your Maſt.

Example. The firſt Proportion runneth thus, for every Yard of length of your Maſt, allow 1 Inch for the Diameter thereof, at the Partners or $\frac{7}{8}$ Parts in or about the middle, and $\frac{3}{4}$ of an Inch at the Head; the length of the Main maſt is 63 Foot, his Diameter is required at the Partners, Quarter and Head.

There is a Second Proportion which I allow for a Sailing Ship, $\frac{1}{4}$ of an Inch of a Foot; and a third Proportion, which is $\frac{1}{4}$ of an Inch, and $\frac{1}{12}$ for every 6 Foot the Maſt is in length.

$\frac{1}{12}$

By the firſt Proportion 3)63(21 F. is 21 In. At the Partners at 1 Inch to 3 Foot.

21 Foot. 7. 8)147(18 Inch: At the Quarter.

21 Foot. 3. 4)63(15 $\frac{1}{2}$ Inches. At the Head.

Second Proportion by $\frac{1}{4}$ of an Inch to a Foot. 4)63(15 $\frac{3}{4}$ Inches at the Partners for the Diameter of the Maſt.

15 $\frac{3}{4}$ the $\frac{7}{8}$ is. 7. 8)105(13 $\frac{3}{4}$ and $\frac{1}{2}$ In. in the middle.

15 $\frac{1}{4}$ the $\frac{3}{4}$ is. 3. 4)45(11 $\frac{3}{4}$ and $\frac{1}{4}$ Inch. at the Head.

I omit the Work of the Third Proportion taken to this.

How to find the Diameter of the Foremaſt, allowing $\frac{1}{4}$ of an Inch to a Foot.

Example. As you wrought for the Main-maſt, ſo work here for the Foremaſt.

Is

57 Foot by 4 is 14 Inches $\frac{1}{4}$ Diameter at the Partners.

14 $\frac{1}{4}$ the $\frac{7}{8}$ is. 7. 8)98(12 $\frac{1}{2}$ neareſt. Inches in the middle.

14 $\frac{1}{4}$ the $\frac{1}{4}$ is. 3. 4)42(10 $\frac{1}{2}$, and near $\frac{1}{4}$. Inches at the Head.

How to find the Diameter of the Boltſprit.

The Boltſprit is commonly the Medium between the Main-maſt and Fore-maſt; the main-maſt is 15 $\frac{1}{4}$ Inches, the Fore-maſt is 14 $\frac{1}{4}$ Inches (Diameter at the Partners) the Medium is 15 Inches for the Diameter of the Boltſprit upon the Stem, the $\frac{7}{8}$ of which is the Diameter in the middle, and $\frac{1}{4}$ the Diameter at the end.

15 Inches at the Stem.

15 the $\frac{7}{8}$ is. 7. 8)105(13 $\frac{1}{8}$ in the middle.

15 the $\frac{1}{4}$ is. 3. 4)45(11 $\frac{1}{4}$ Inches. Diameter at the end.

How to find the Diameter of the Mizen-Maſt in the Partners middle, and at the Head.

Example. Mizen-Maſt 43 Foot, $\frac{1}{4}$ is the Diameter at the Partners $\frac{7}{8}$ the Diameter in the middle $\frac{3}{4}$, is the Diameter at the Head.

4)43(10 $\frac{1}{4}$ Inches Diameter at the Partners.

10 $\frac{1}{4}$ the $\frac{7}{8}$ is. 7. 8)70(9 Inches. The Diameter at the middle.

10 $\frac{1}{4}$ the $\frac{3}{4}$ is. 3. 4)30(7 $\frac{1}{2}$ Inches. The Diameter at the end.

How to find the Diameter at the Maintop-maſt, at the Cap, Middle and Head.

Example. The $\frac{5}{8}$ of the Diameter of the Main-maſt, at the Partner which is 15 $\frac{3}{4}$ inches, is the Diameter of the Maintop-maſt at the Cap, the Main maſt is 15 $\frac{3}{4}$ Inches, whoſe $\frac{5}{8}$ is neareſt 10 inches at the Cap, $\frac{7}{8}$ of which is 8 inches $\frac{3}{4}$ for the Diameter in the middle, and $\frac{3}{4}$ of the ſame is 7 $\frac{1}{2}$ inches at the Head.

How to find the Diameter of the Foretop-maſt.

Example. The proportion is $\frac{5}{8}$ of the Diameter of the Fore-maſt at the Partners, for the Diameter of Foretop maſt and $\frac{7}{8}$ for the middle, and for the head at the Cap, the Fore-maſt is 14 $\frac{1}{4}$ of an Inch at the Partner.

14 ¼ Inches — 8 ⅛ — 8 ¼ Inches.

5 — 7 — 3

8) 70 (8 ¾ Inches. — 8) 56 (7 ¼ Inches. — 4) 24 (6 Inches.

6 — 2 — 0

Diameter at the Cap. — the Diameter in the middle. — the Diameter at the head.

How to find the length of the Heads of the Low Maſt and Top Maſt.

Example. The proportion is 1¼ of an Inch for every Foot of the length of the Maſt, from the lower part of the Croſs Tree accounted for the length of your main Head.

Note, The proportion for the Truſſel trees is ⅓ of the breadth of the Ship for the length, and one half the Diametre of the waſt at the Rounds for the depth and ¼ the Diameter of the maſt Head for the breadth. Thus the proportion runs for each Maſt.

Example. The Main maſt 63 Foot long, the length at the Head is required.

Inch

12, 63 Foot is — 5 Foot 3 Inches

¼ of an inch to a Foot is — 1 Foot 3 ¾ Inches

is 6 Foot 6¼ the length of the Main maſt, at the Head. In the ſame manner work for the length of the Heads of all the other maſts.

How to find the Diameter of the Yards.

Example. How to find the Diameter of the Main Yard at the Slinge at the Quarter and at the Yard Arms.

Main Yard 50 Foot 7 Inches at 1 In. to 3 Foor, the proportion allowed to the maſt is near 17 Yards which will be 16 Inches ¼ at the *Slings* ¾ of 17 is 12 ¾ Inch at the Quarters and ⅓ the proportion of the Diameter at the Strings for the Diameter at the Yard Arm, is 5 Inches and a half.

The 2d proportion at ¼ of an Inch to a Foot of length.

F. Inches. — By ¼ — By ⅓

50 7 is 50 ½ Quarters — 12 ½ at the length. — 12 ½ at Slings.

is 12 Inches ½ at the *Slings*. — 3 — 3) 12 (4 ⅛ the Diameter at the Yard-Arm.

4) 58 (9 Inches.

0

at the Quarter.

How to find the Diameter of the Fore-Yard.

Example. The Fore-Yard is 43 Foot 5 Inches at the Slings at ¼ of an Inch to a Foot, as the Proportion runneth here is 43 ½ Quarters, is 10 Inches ¾, or near 11 Inches at the Quarter, ¾ of 11 is 8 Inches ¼, Diameter at the *Slings*, ⅓ of 11 is 3 Inches and ⅔ the Diameter at the Yard-Arm.

Example How to find the Diameter of the *Mizen* yard, which is 10 Inches at the *Sling*, lowing it an *Inch* leſs than the Fore-yard through there, ⅘ thereof at the lower Quarter is 8 ½, and better there in Inches, ⅖ at the lower end is 4 Inches, at the upper Quarter ⅘ is 7 ⅕ Inches, and ¼ at the upper end is 2 ½ Inches, and better, the Diameter at the upper end.

Thus

Thus you may Proportion your Yards, taking to the leſſer Proportion for ſmall and nimble Sailing Ships, having a regard that you have the beſt of Wood, and thoſe new felled. Thus you may proceed with all the ſmall Yards, and at all times Proportion the Yards of a *Ship* to any Burthen whatſoever, by the ſame Rules.

How to Rig a Ship of any Burthen whatſoever, by Proportion,

Example. THE Dimenſion of the *Main* maſt is 63 Foot in length, the *Main*-Yard 50 Foot 7 Inches, the Proportion run thus,

How to find the length of the Rigging for the Main-maſt.

Two Thirds, the length of the *Main* maſt, is the length of the firſt *Shrouds*, always mind to allow for the reſt as they Rake Aft; ⅔ the length of the *Main* maſt, for the Pennant double once the length of the *Main*-maſt, from the Croſs-trees to the Deck, and ½ part of the length, is the length of the *Main*-ſtay.

Four times the length of the *Main* maſt from the Deck to the Croſs-trees, is the length of the Main-Jeers, if four fold, then 5 times.

How to find the length of the Rigging belonging unto the Main-Maſt, that bear their Proportions from the length of the Main-Yard.

Once and one half the length of the Main-yard, gives the length of the Sturtainſail Halliards.

Twice and ½ the length of the Main maſt, gives the length of the *Stay*ſail Halliards.

Main Paral Ropes, is ⅔ the length of the *Main*-yard.

Three times the length of the *Main*-yard, gives the length of the *Main*-Liſts.

Twice and ½ the length of the Main-yard, gives the length of the *Main*-braces.

Once the length of the *Main*-yard, is the length of the *Main*-Bowline

Twice and ½ the length of the *Main* yard, is the length of the *Main*-Clewgarnet.

Twice the length of the *Main*-yard, gives the length of the *Main*-Leechlines.

Once the length of the *Main*-yard, for the length of the *Main*-Tack.

Twice the length of the *Main*-yard, gives the length of the *Main* Sheets.

Twice the length of the *Main*-yard, gives the length of the Topſail-Sheers.

Once the length of the *Main*-yard, gives the length of the Runner of the *Main* Tackle.

How to find the length of the Rigging belonging to the Foremaſt, by the length of the Foremaſt and Fore-yard.

The Fore-maſt 57 Foot in length, the Fore-yard 43 Foot, the Proportions run thus.

Two

Two thirds the length of the Fore-maſt, is the length of the firſt Shroud, you muſt have a regard to allow for the Rake Aft, and for their Riſing at the Maſt-Head.

Two thirds the length of the firſt Shroud, gives the length of the Pennant double.

Once the length of the Fore-maſt, gives the length of the Fore-ſtay.

Three times the length of the Fore-yard, gives the length of the Fore-lifts.

Twice the length from the Deck to the Croſs-trees, gives the length of the Fore Buntlines.

Twice the length of the Fore yard, gives the length of the Fore Braces.

Two thirds the length of the Fore yard, gives the length of the Parall Rope.

Two times and one half the length of the Fore yard, gives the length of the Fore Sheets.

Three times the length of the Fore yard, gives the length of the Fore Clewgarnets.

Two times the length of the Fore yard, gives the length of the Foretopſail Sheets.

Two times the length of the Fore yard, gives the length of the Leechline.

Once the length of the Fore yard, gives the length of the Runner of the Tackle.

Two times and one half the length of the Fore yard, gives the length of the Main Tackle fall.

Once and one fourth the length of the Fore yard, gives the length of the Fore Bowline.

How to find the length of the Rigging belonging to the Mizen-Maſt.

Four times the length from the Croſs-trees to the Deck, is the length of the Mizen Halliards.

Twice the length of the Croſs-trees of the Mizen Maſt to the Deck, gives the length of the Braels.

Once and one third the length of the Mizen Maſt, gives the length of the lower Braels.

The length of the Maſt from the Croſs-trees to the Gunwall, is the length of the Shroud.

The length of this Maſt, gives the length of the Mizen Stay.

The length and one half the length of the Mizen yard, is the length of the Mizen Sheet.

The Truſs 1 ½ the length of the yard.

How to find the length of the Rigging belonging to the Maintop-maſt.

One Half the Length of the Maſt for the Pennant.

Near the length of the Maſt for the Shrouds.

Once and one half the length of the Maintop-maſt, gives the length of the Stay.

Twice and one half the length of the Main-yard, gives the length of the Maintopſail Braces.

Twice and one half the length of the Main-yard, gives the length of the Maintopſail Lifts.

Three times the length of the Main-yard gives the length of Maintopſail Haliards.

Twice the length of the Maintopſail-yard, gives the length of the Leechlines;

Once

Once and one quarter the length of the Main ſhrouds gives the length of the top-rope.

Four times the length of the Main-maſt, from the Deck to the Croſs-Trees, gives the length of the Maintop-Rope Fall.

One Third of the length of the Topſail-yard, gives the length of the Pennant of the Maintopſail-Braces.

Once the length and one half of the Main-yard, is the length of the Maintop-maſt Backſtays.

How to find the length of the Rigging for the Foretop-maſt.

One third the length of the Shrouds is the length of the Pennants of the Burtons.

The length of the Shrouds is the length of the Maſt, from the Croſs-trees to the Top.

Twice and one half the length of the Fore yard is the length of the Foretop-maſt Lifts.

Three times the Length of the Fore yard, gives the length of the Foretop-maſt Clewlines.

Twice ½ the length of the Fore-yard gives the length of the Foretopſail Braces.

Twice the length of the Fore yard gives the length of the Bowlines.

Once the length of the topmaſt gives the length of the Foretop-maſt Tye.

Once and one half the length of the Fore yard, gives the length of the Runner.

Twice the length of the Fore yard, gives the length of the Foretopſail Halliards.

Once and one third the length of the Topmaſt, gives the length of the Foretopmaſt-ſtay.

Once and one half the length of the Fore yard, gives the length of the Foretopmaſt Backſtay.

Once the length of the Foretopſail yard, gives the length of the Foretopſail Buntline.

How to find the length of the Mizentop-maſt Rigging.

The length of the Maſt from the Croſs-Trees to the Heel, is the length of the Shrouds.

Once and one half the length of the Maſt, is the length of the Stay.

Twice the length of the Maſt, is the length of the Lifts, if ſingle, and double 3 times.

Once and ½ the length of the Mizen yard, is the length of the Mizentopſail Braces.

Once and one half the length of the Crojack yard, gives the length of the Bowline.

Twice and one half the length of the Crojack yard, gives the length of the Crojack Braces.

Twice and one half the length of the Crojack Braces is the length of the Mizentop-ſail Sheet.

Twice and one half the length of the Crojack, gives the length of the Mizentopſail Clewlines.

Once and two thirds of the length of the Mizen yard, is the length of the Mizen Halliards.

Once the length of the Topmaſt, is the length of the Tye.

How to find the length of the Spritſail Topmaſt Rigging.

The length of the Maſt from the Heel to the Croſs-Trees, is the length of the Shrouds.

Three

Three times the length of the Maſt, is the length of the Halliards.
Three times the length of the Maſt, is the length of the Spritſail Topſail Lifts.
Twice the length of the Spritſail yard, gives the length of the Clewlines.
Two Times the length of the Spritſail yard for the Spitſail topſail Braces.
Once the length of the Maſt for the length of the Tye.

How to find the length of the Maintopgallant Rigging.

Once the length of the Maſt from the Croſs-Trees, gives the length of the Shrouds you may cut it one Foot ſhorter.
Twice the length, and one quarter the length of the Topmaſt Shrowds gives the length of the Maintopgallant Stay.
Twice the length of the Maintopgallant-maſt, gives the length of the Lifts, if ſingle, if double three times.
Half the length of the Yard is the length of the Paral Rope.
Twice the length of the Main yard gives the length of the Maintopgallant Braces.
Twice the length of the Main yard gives the length of the Bowlines.
The length of this Maſt is the length of the Tye.
Twice and $\frac{1}{4}$ the length of the Main yard gives the length of the Maintopgallant Halliards.

The Length of the Foretopgallant Rigging.

A foot leſs than the length of the Maſt is the length of the Shrouds.
Once and one half the length of the Fore yard is the length of the Foretopgallant Stay.
Twice the length of the maſt is the Lifts ſingle, if double three times.
Twice and one half the length of the Fore yard, is the length of the Foretopgallant Braces.
Alſo twice and one half gives the length of the Bowlines.
Likewiſe twice and one half gives the length of the Halliards.
This Proportion is not ſo Exact as the Model.

How to find the Circumference or ſize of your Rigging.

The Proportion is $\frac{1}{2}$ the Diameter of the Main-maſt, for the Circumference of the Main Stay, Main-maſt 15 Inches, $\frac{1}{2}$ Diameter is 7 $\frac{3}{4}$ and $\frac{1}{4}$ the Circumference of the Main Stay.
The Fore Stay is $\frac{1}{2}$, the Diameter of the Foremaſt in the middle, which is 12 $\frac{1}{2}$, whoſe half is 6 $\frac{1}{4}$, for the Circumference of the Fore Stay.
The Main Shrouds is $\frac{2}{3}$ of the Circumference of the Main Stay, which is 7 $\frac{3}{4}$ Inches whoſe $\frac{2}{3}$ is 4 $\frac{1}{12}$ Inches, for the Circumference of the Main Shrouds.

How to find the Circumference of the Fore Shrouds.

Example. The Fore Stay is 6 $\frac{1}{4}$ of an Inch, the Circumference $\frac{2}{3}$ thereof is 4 Inches and $\frac{1}{12}$, for the Circumference of the Fore Shrouds.

How

How to find the Circumference of the Mizen Stay and Shrouds.

The Diameter of the Mizen maſt at the head is near 8 Inches, the $\frac{1}{2}$ thereof is near 4 Inches for the Circumference of the Mizen Stay, $\frac{2}{3}$ thereof is 2 $\frac{2}{3}$ Inches, the Circumference of the Mizen Shrouds.
By the ſame Rule you may find the Size of the Maintopmaſt Stay and Shrouds, and Foretopmaſt Shrouds and Stays, and Back Stays for the Main and Foretopmaſt.
Note, The top Ropes, the Runners of the Tackels and Topmaſt-tye, are $\frac{3}{4}$ of the Circumference of the Main Shrouds.

How to Size your Running Rigging.

The Size of the Main Tacks is one third of the Diameter of the Main maſt, for there Circumference, $\frac{1}{3}$ the Diameter of the Foremaſt, for the Circumference of the Foretacks, Topſail Sheets, Taper-laid is $\frac{1}{4}$ of the Circumference of the Main Shrouds, allowing $\frac{1}{4}$ of an Inch more at the Knot; the Foretopſail Sheet in the like proportion with the Fore Shrouds, the Main Sheets $\frac{1}{4}$ of an Inch leſs than the $\frac{1}{2}$ of the Circumference of the Main Shrouds; the Fore Sheets bearing the like proportion with the Fore Shrouds, Tackle Falls, Top Rope Falls, is $\frac{1}{2}$ the Circumference of the Main Shrouds, Aft and Forward, the like Proportion with the Fore Shrouds. The Clewgarnets, Buntline Lifts, Braces, and all the other ſmall Rigging according to the Burthen of the Ship; if you be for nimble and ſmall Rigging, be ſure it be good, and then you may be bold to ſize them $\frac{1}{4}$ an Inch finer and ſmaller, Fore and Aft, than your Proportion. This Proportion given is fine enough, but the general way of Rigging exceeds it; ſo that when your Rigging, Standing or Running, be ſmaller, it muſt be of as good Stuff as your Shrouds, which will mend the Sailing of any Ship.

Shewing how to Delineate and lay down the Maſt and Yards, in any Model great or ſmall, and thereby to know the length of the Standing and Running Rigging Exactly.

Example. First Draw the Body of the Ship on a large Sheet of Paper, according to the Direction given you in Folio 43; then place your Maſts; firſt the Main-Maſt in the Miſhip, or 1, or 2, or 3 Foot Abaft it, Erecting a Perpendicular from the Point where you deſign to ſtep the ſame, and on that Perpendicular ſet off the length of your Main-Maſt, from your Scale, which is found to be 63 Foot, by the Rule given in page 70. Then ſet off the Diameter of the Main-maſt at the Partners, 15 inches and $\frac{1}{2}$, and in the middle 14 Inches, and at the Head near 12 Inches, found by

the

the Directions aforesaid, and then draw a Line thro' these Pricks, the length aforesaid; this shall be the Main-mast; then set off the length of the mast head found in Page or Folio 76 to be by the Rule of Proportion 6 Foot 6 Inches ; this is called the head of the Mast; then place your Trussel trees, let the length of them be of the Breadth of the Ship, the Depth half the thickness of the Mast-Head, as by the Rule in Folio 76. Thus is your Main-mast compleat; then Draw a Line from the Main mast, from the top of the Trussel tree to the Stem, This line is the Main stay, allowing for the Collar of the Stay, and seasing on of your dead Eye 9 Foot, your Main stay found by length single 54 foot, both added is 63 foot, the length of the Main-mast.

To find the length of the Main-Shrouds.

Draw a Line from the Trussel trees into 1 foot of the length of the Deck, that will be the length of the Foremost Main shroud; the rest must be allowed for Rake Aft, 4, 6 or 10 inches of length, more or less, according as their Rake is.

How to find the Main-yard in the Model.

Example. By the proportion in page 72 the Main-yard is 50 foot 5 in. in length, and at the Slings 12 inches, at the quarter of the Yard 9 inches , Diameter at the Yard-arm 4 in. Now at 5 Foot below the Trussel trees place your Main-yard, by drawing a Parallel line to the Keel, and on this line, in the middle of the Main mast set off 25 Foot 3 In. and a half before the Main-mast, and Abaft it, which is the length; then set off 12 Inches and a half, for the thickness of the Yard downward. This part is called the Slings. At the quarter set off 9 Inches and a half, and at the Yard-Arm 4 Inches and one third for the Diameter of the Yard, and draw a Line from the Sling to the end, both ways, so have you the Main yard Hoisted and Aloft. The same Yard Lowered, and it 5 foot of the Deck is termed the Main-yard a *Portland* By these Directions you may draw any Masts or Yards belonging to your ship. I proceed,

Shewing how to Draw the Rigging, and how you shall find their Length.

Example. In the Draught you have the Lower Yards hoisted, and Aportlong, and the Topsail yards hoisted, and on the Cap, we require the length of the Main sheets From the quarter of the Main-yard hoisted draw a line to the quarter of your Ship, where you place your Ring bolt for the standing part of your Main-sheet Measure this line, which is 51 foot, then draw another Line from the same place, on the Yard, to the Block on the Quarter Deck, where you Reeve your Sheet, Measure the same it is 43 Foot; then allow 9 Foot for the length of your Sheet within Board; all added is 100 Foot, or 16 Fathom, and 4 Foot the length of the Main sheet, the Proportion of twice the length of the Main-yard agrees with the Demonstration.

How to Draw the Maintopsail sheet, and find its length.

Draw a Line from the topsail sheet Block, at the Main-Yard, hoisted or Aportlong and

and a Line from the same to the Topsail sheet block at the Slings, and from thence a Line down to the Deck, with 4 or 5 foot to belay, or make fast your end; all Measured is 85 Foot or 14 Fathom, the length of the Maintopsal sheet.

The Rule, by proportion, is one and a half times the length of the Main Yard, which is 12 Fathom and a half. This differs somewhat from the former Rule.

How to find the length of the Maintopsail Clewline.

Draw two Lines from the Topsail sheet block, or the block of the Clew of the Maintopsail, to the Clewline block on the Maintopsail Yard hoisted at the Quarter, and measure them they are 80 foot, then a Line from the quarter of the Topsail Yard, thro' the Maintop, and from thence a Line down to the Deck, Measured is 80 foot, all added is 160 Foot or 26 Fathom and 4 Foot, the length of the Maintopsail Clewline. The Rule of Proportion, by the Main-yard, hold here.

To draw the Maintopmast stay. A Line drawn from the Cross Trees at the Maintopmast head unto the Foremast head, from thence down to the Forecastle Deck, allowing for the Collar, and the length of your Tackel is your Maintopmast stay, and the length thereof.

To draw the Maintopmast Back Stay. Draw a Line from the Maintopmast Cross Trees into 3 Foot of your Dead Eye on the side, and that shall be the length of your Back stay, which being measured is 11 Fathom.

To draw your Maintopsail Brace. The length of the Pennant is of the Yard, from the Pennant Blocks draw 2 Lines unto the Mizen mast head, by the Crojack Yard, to the place on the Mizen Shrouds where you assign your Block; to Reeve your Brace thro', measure these Lines, and the distance to the Deck, all is 21 Fathom the length. After this manner you may lay down each Running or Standing Rope belonging to any Ship or Vessel, and find their length exactly.

The Model of the Ship Described, shewing her Parts, Masts, Yards and Rigging.

Example.

A Denotes the Keel.
B the Stem.
C the Stern Post.
D the Mizen mast.
E the Hould.
F the Fore mast.
G the Main mast.
H the Decks.
I the Rudder.
K the Main Yard.
L the Fore Yard.
M the Mizen Yard.
N the Maintopsail Yard.
O the Foretopsail Yard hoisted.
P the Maintopgallant Yard hoisted.
Q the Foretopgallant Yard hoisted.
R the Mizentopsail Yard.
S the Crojack Yard.
T the Spritsail Yard.
V the Spritsail-topsail Yard.
W the Boltsprit.
Y the Mizentopmast.
A the Maintopmast.
B the Foretopmast.
C the Maintopgallantmast.
Z the Foretopgallantmast.
P the top of the Poop.
W the top of the Waste or Gunwall by the Mainmast.

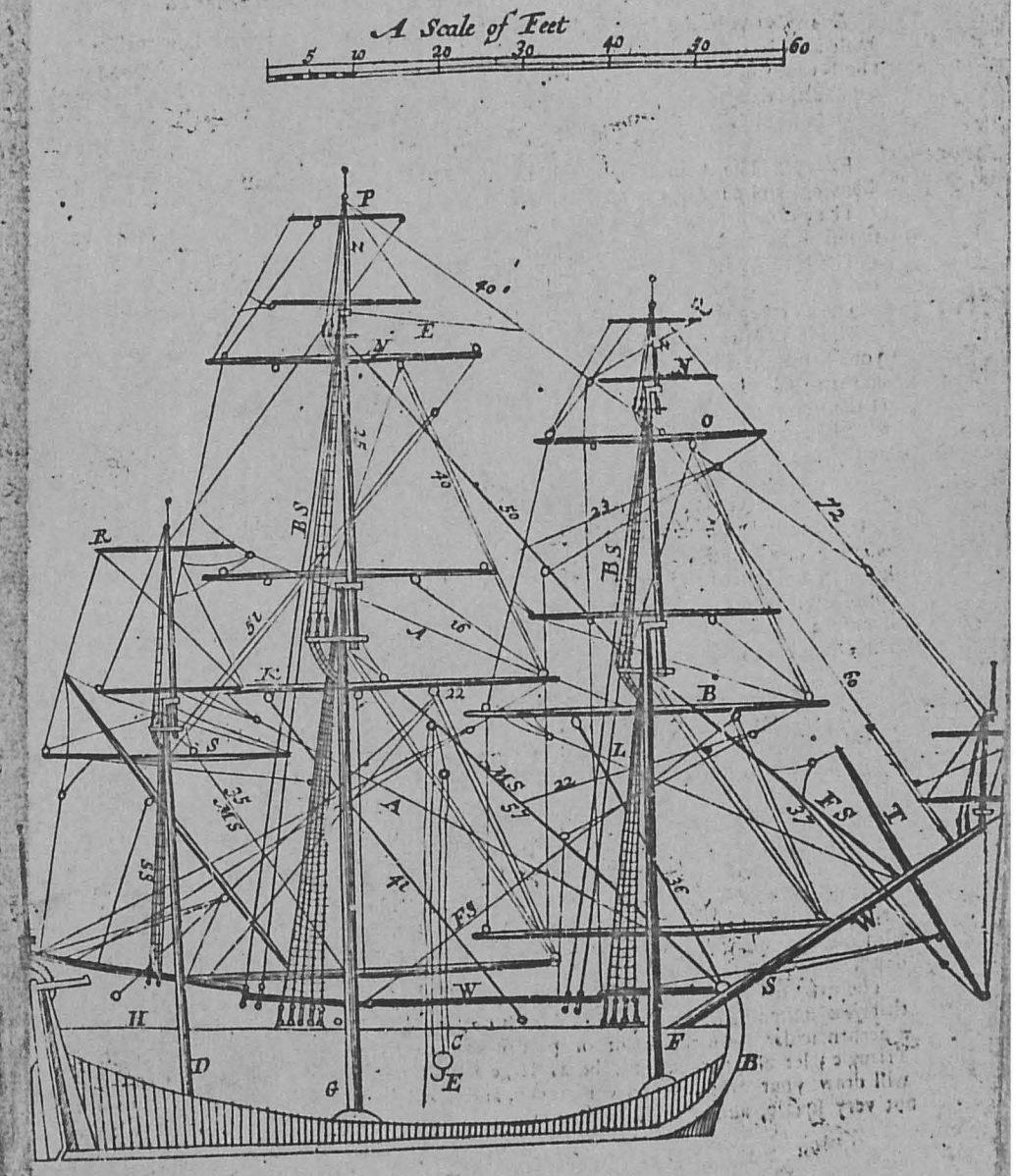
The Description of the Standing and Running Rigging.

	Fathom	F.
MS the Main Sheets is	16	4
FS the Fore Sheets is	18	0
SS the Main Shrouds is	7	0
SS the Fore Shrouds	6	2
SS the Mizen Shrouds is	4	2
37 Foot the Fore Stay is	7 Cut	2
57 Foot the Main Stay is	10 Cut	3
BS the Maintop Back stays is	12	0
BS the Foretopmast Back stays	11	0
A the length Main Bowline	12	0
B the Foretop Bowline is	18	0
C the Burton and Fall is	16	0
D the Fore Clewgarnet is	14	0
E the Maintopgallant Bowline	18	0

	Fathom	F.
16 Maintopsail Sheets is	14	0
40 Maintopsail Clewline is	25	0
33 Foretopsail Clewline is	22	0
41 the Main Tack is	8 Cut	5
36 the Fore Tack	7 Cut	4
47 the Main Braces is	18	0
22 the Fore Braces is	12	0
51 the Maintopsail Braces is	22	0
23 the Foretopsail Braces is	15	3
50 Maintopmast Stay is	15	0
60 Foretopmast Stay is	10	0
40 Maintopgallant Stay is	6	3
72 Foretopgallant Stay is	12	0

Thus you may describe any Rope omitted in this *Model*, and find their length in Feet by the *Scale*, which divided by 6 *Foot* gives the *Fathom*; the Ropes properly called so in a *Ship*, are the Rudder Rope, the Entering Rope, the Leather Rope, the Well Rope, the Bucket Rope, the Cat Rope, and *Fish* Rope. Thus have you most of the Running and *Standing* Rigging belonging to a *Ship* Demonstrated, with their length in *Fathom* and *Foot*.

The



This Scheme or Figure, sheweth the Description of the Sail belonging to any Ship, with Directions how to make them.

Example. As in the former Figure, in the *Model* Rigged. After your Low-mast and Top-mast are erected, and your Yards all hoisted, divide your Yards into the equal parts of the breadth of your Cloath, and make your *Sails*, allowing for *Stretching*; if you will be exact, that your *Sail* comes even with the Cleets when *Stretched*.

The Dimensions of the Sailes.

Example. The *Main Sail*, known by the *Letter* A, is 18 Cloaths, 11 ½ Yards deep Clewing, and cut *Square* 10 Yards.

The Foresail is 9 Yards deep, is 15 ½ Cloaths cut Clewing, if cut square 9 Yards depth, signified by the Letter B.

The Maintopsail is 11 Yards deep, and 12 Cloaths at the head, signified by the Letter C.

The Foretopsail is 9 ½ Yards deep, & 9 ½ Cloaths at the head, signified by the Letter D.

The less Clewing the better, you must have a regard to your Ship in the largeness of your Sails. A stiff Ship requires the larger *Sailes*; the Letter E signifies the Spritsail, and is 13 Cloaths 6 Yards deep; G the Spritsail Topsail, 8 Cloaths 4 Yards and ½ deep; H the Foretopgallantsail 5 ½ Cloaths, 3 Yards and ½ deep; I the Maintopgallantsail 6 ½ Cloaths at the head, and 4 Yards and ½ deep; K the Mizentopsail 7 Cloaths at the head, and 7 Yards deep; E the Mizen 10 Cloaths and 12 Yards deep.

Directions concerning your Sails.

It is needful to have some Knowledge how to make a *Sail*. In case you should be wanting of a *Sail*-maker, an account of the respective *Sails* belonging to a Ship, you have Demonstrated to you in their breadth and depth; in regard there are few or no *Ships*, when Manned for their Voyage, but hath several of the Company, that can handle a Palme and Needle: Such *Seamen* (if Occasion offers) may make a *Sail* by Directions given them, it being cut out to their hand.

Directions for making a Mainsail.

Example. Measure the length of your *Main* mast from the Cross Trees to the Deck, which, suppose it to be 43 *Foot*, than allow 5 Foot from the Cross *Trees* to the Main yard, and 1 Foot for the depth of the Main yard, than allow 6 *Foot* for the depth of the *Sail* from the Deck, all makes 12 *Foot*, taken from 43 *Foot* leaves 31 Foot; the depth of the *Sail* is 10 yards and one foot, to which you must add for your Clewing as you please, the less Clewing the fairer the *Sail* will stand, for the breadth of the *Sail* you are Governed by the yard; this yard of 50 *Foot* 18 Cloaths cut will be sufficient. *Note*, a Cloath of *Hollands*, Duck Work, is 2 *Foot* 4 Inches and ½ in the breadth; in putting your Cloaths together at the head, you must keep your Proportion at the head, with the same breadth for every Cloath as with your first 2 Cloaths, with the same depth until you come to the fair double *Seam*.

The Staysails are all cut, as the Stays makes their Angles, and the length thereon that you design to hoist. The last Cloath coming to a Parallel with the Horizon, by a perpendicular from the Point or part of the Stay you hoist to, which maketh a Triangle; let all your Staysails be as large as possible, they are fair Weather-sails, and will draw your Ship an end very much, and much more when your other Sails are not very square, and along-ship, then they have the true Wind.

CHAP.

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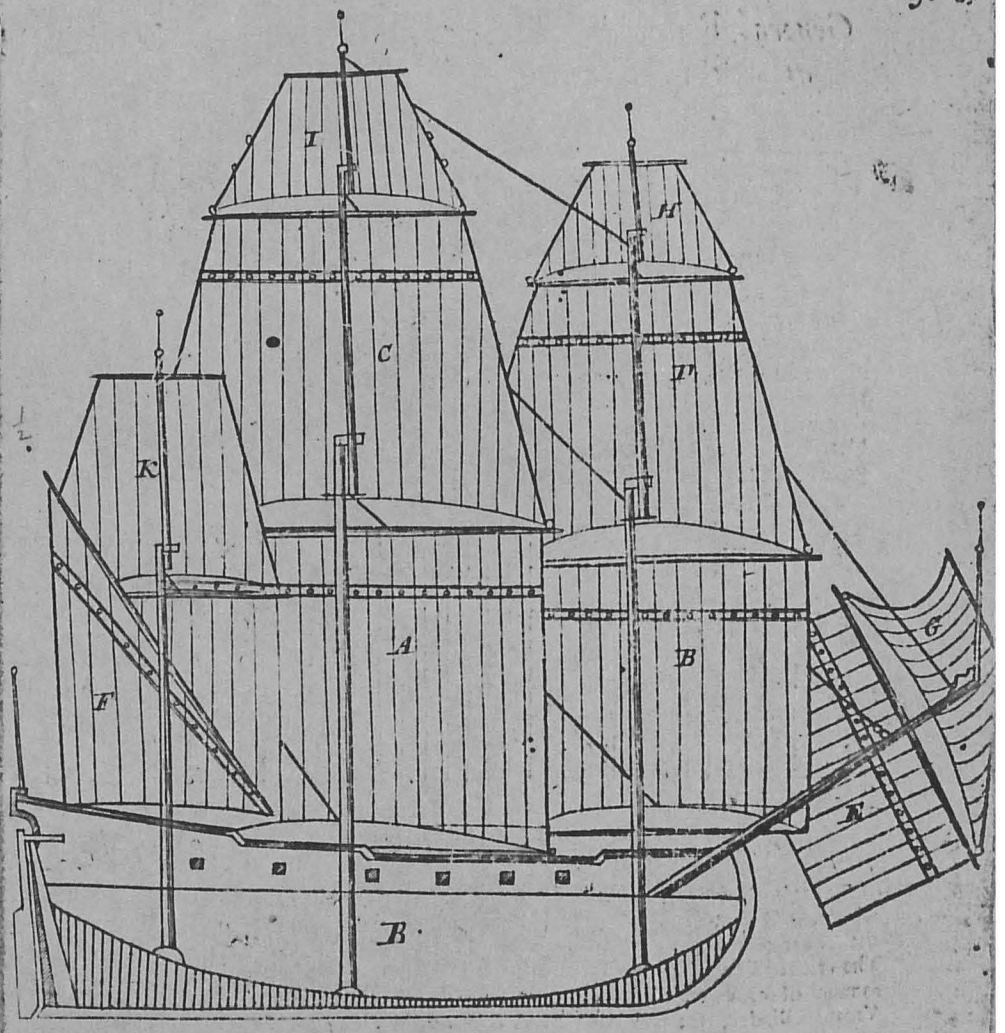


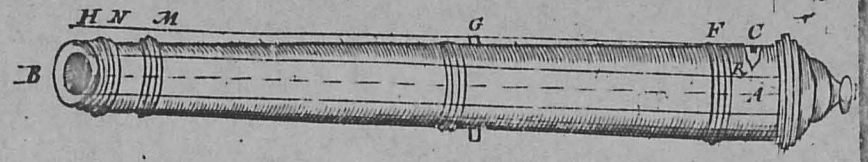
CHAP. IV.

General Rules in the Art of Gunnery, to be obſerv'd at Sea in a Ship, and pertains to Sea-Gunners.

PROBLEM I.

The way to demonſtrate a Cannon, Culverin or Saker.

Example. Suppoſe a Saker 12 Foot in length, and 4 In. in the Bore. Draw a line, and ſet off 12 Foot; to which draw a Line Parallel of 4 inches, and ſet off at the Breech one Diameter for the Diameter on each ſide of the Diameter of the Bore, that ſhall be the thickneſs of the Piece there, then ſet half the Diameter off at the Moſſel upward and downward, and draw a Line from the Breech to the Moſſel, that is the thickneſs of the Metal of the Piece; the Concave divided into two equal parts is the middle of the Piece, your Rings being placed on, and Trunnions, your Deſcription is finiſhed.



The Explanation of a Saker, Demi-Culverin, or Cannon, or any other Piece of Ordnance.

Example. The Superficies is the outſide of the Piece, round about the Pricked Line within, A B is the middle thereof, and the Pricked Circle, within the Concave ſignifie the Taper of the Piece, R A within the Concave ſignifies the Piece is not true Bored. The pricked line at H is the Piece diſperted. The hollow Concave Cilinder is the bore, and as much of this as contains the Powder and Shot, is called the Chamber, the other part her Vacant Cilinder, the prickd Line A B is the middle thereof. The Spindals, or Ears are called the Trunnions. The Pommel at the Coyle, is the Caſacable Deck marked P, the touch Hole, the Metal behind, the ſame; her Breech or Coyle C, the Ring, at the Touch hole to the baſe Ring above the touch hole, that Ring is called the reinforced ring, the

the Trunnion ring, G the ring next the mouth, M the muzzle ring, N the ring next the Trunnion ring, G the ring next the mouth, M the muzzle ring, N the ring next the mouth between the Trunnion ring, and the muzzle ring is the Corniſh ring; all the rings and circles about the muzzle is the frieze; the whole length is called the Chace.

PROBLEM II.

Inſtruments required that a Gunner ſhould be Furniſhed with.

A pair of large Caliaber Compaſſes, a ſmall pair of Braſs heights for Shot, a Gunners Scale, a Gunners Quadrant, a Geometrical Square for Mountures or Levels, a pair of Braſs Compaſſes.

PROBLEM. III.

How to Diſpart a piece of Ordinance.

Example. Divide the Concave, or your piece by a right Line drawn thro' your piece, as the prickt Line A B, from the breech to the muzzle exact; by taking the Diameter at the baſe ring, and the Diameter at the muzzle; the difference will be the middle of the piece if it be true Bored, from which, with your Quadrant or Eye, allowing for the height of your Diſpart, as is denoted at H, Levelling your piece to the mark you have your end.

PROBLEM IV.

How to know when your piece is well Fortified.

Example. Meaſure the thickneſs at the Breech, Trunnian and Neck, with a pair of Caliabers, a home bored piece; the Diameter is leſs by the height, divided by 2, is the thickneſs at any place. *Note*, There are 3 degrees uſed in Fortifying Cannon and Culverin. 1ſt, Is Ordinary Fortifying, and are called Ligitimate. 2d, Thoſe leſſened Baſtard pieces. 3d, Are double Fortified, and are called Extraordinary: Theſe have one Diameter of their Bore, in thickneſs of Metal, at the Touch hole, [illegible], at the Trunnions, [illegible] at the muzzle, the leſſened Cannon [illegible] of the Diameter, in thickneſs of the Bore at the Breech, and [illegible] at the Trunnions, and [illegible] at the muzzle; the Ordinary Cannon, [illegible] at the Breech, [illegible] at the Trunnions, and [illegible] at the muzzle, Culverin, and all double Fortified Culverin, one Diameter at the Touch hole, [illegible] at the Trunnions, [illegible] at the muzzle, Ordinary Fortified Culverin, is as the double Fortified Cannon, and the leſſned Culverin, as the Ordinary Fortified Cannon.

PROBLEM V.

How to find the Flaws, Cracks, or Honey Combs in a piece of Ordinance.

Example. Clean your piece, put in your Searcher made with ſeveral Springs pointing upwards, which, put into the piece up to the bottom of the Bore; turn it round, and ſearch

ſearch the Chaſe, if there be any Flaws or Honey Combs, you will find them in your ſearch, or thus ſtrike on your piece with a hammer, if the ſound be clear the piece is ſound, if the ſound be hoarſe their is ſome crack. Thus you may try whether an Anchor be ſound, or Maſt, or piece of Timber, laying your Ear to them and a blow Struck, if the ſound be clear they are ſound, if hoarſe their is defect in them.

PROBLEM VI.

How to fit your Shot for uſe to any Gun.

Example. Divide the Diameter or Height of the Bore of any Gun, into 20 equal Parts, 19 of thoſe Parts, is the fit Height of the Shot for that Gun.

PROBLEM VII.

How to find how much Powder is ſufficient both for Proofe and Service for any piece of Ordinance.

Example. Multiply the weight of your Shot by the number of Callibers, in the Circumference of your piece at the breech, that Product Multiplyed by 8 for Proofe, and by 6 for Service; each Divided by 96, the Quotient gives the Pounds, the remainder the Ounces that is required.

Example. Suppoſe a Bullet of 9 C.wt. be fit for a Gun of 7 Diameter of the bore, in the Circumference at the Breech. The quantity of Powder is required to try her for Proof, and likewiſe for Service.

9 Pound weight of the Shot
7 Diameters of the Circumſer.

63
8

96) 504 (5 lb
24
16
144
24
96) 384 (4
00

3
4 for Proof

9 Pound the weight of the ſhot.
7 Diameters of the Circumference.

63
6

96) 378 (3 lb
90
r 16

3
14 ¼ for Proof.

96) 1440 (14 ¼ Ounces.
456
6

PROBLEM VIII.

How to make your Ladles for your Guns.

Example. Cut the breadth of your Ladle 2 Diameters of your Shot, ¼ part leſt open for the Powder to fall freely out, when you turn it round in the Piece, let them differ,

fer, according as the Piece is Fortified, for double Fortified Cannon, 2 ½ Diameter of the Shot, for the length, from the Staff or Ladle Head, for ordinary Cannon 2 Diameters, for Culverin, or Demi-culverin 3 Diameters of the Shot, for their lengths three and one half, for leſſer Guns, to Load them at once, double the length of your Ladle; and that ſhall be your Charger to fill your Cartridges with. *Note*, a Ladle, 9 Diameters of the Shot in length, and 2 in Breadth, will hold the weight of the ſhot in Powder. *Note* alſo, Iron Ordnance are allowed but ¾ of the Weight in Powder, that is allowed to Braſs.

PROBLEM IX.

How to make your Formers, and Cartridges for any ſort of Ordnance.

Example. Take the height of the bore of the Piece, and allow ¼ of an Inch if you make Paper, and ½ an inch of your Diameter for the vent, if you make your Cartridges with Canvas. Let your Cartridge, be it Paper or Parchment, be cut three times the length of the Diameter for the breadth, and 3 times the Diameter for the length, for Cannon or Demi-Culverin; but for Saker or Faulcon, and other ſmaller Pieces 3 and ½ and 4 times for their Length. Mark them for the Abatement, that if you meet with any hot Service, you may Abate or Augment to their Charge, as occaſion requires. Let your Former be made to your Height, if ¼, or ½ an Inch of the Diameter of the Piece, and of a fit length, and Tallow it, that your Cartridge may come eaſie of. If your Piece be Taper Bored, your former muſt be Tapered accordingly: Paſte them, Sewing them I hold beſt, and fix your bottoms and Mark them.

PROBLEM X.

Having the Weight of one Bullet how to know the Weight of another.

Example. Suppoſe an Iron Bullet of 4 inches Diameter, weighing 9 lb.wt. what ſhall a Bullet of 8 Inches Diameter weigh? The Rule is cube each Diameter, and ſay, As the cube of 4 is to 9 Pound, the Weight of the ſhot given, ſo is the cube of 8 to the weight of the ſhot required.

4 Inches Diameter.
4
16
4
64 the cube.

8 Inches Diameter.
8
64
8
512 the cube.

As 64 is to 9 ſo is 512

512
9

64) 4608 (lb.wt.
120 (72
0

A ſhot of 8 Inches, weigh 72, that is 8 times the Weight of a ſhot of 4 Inches, which is but double the Diameter.

The Proportion that one Metal beareth with another.

The proportion of Lead to Iron, is as	2 to 1
The proportion of Lead to Braſs, is as	2¼ to 1
Lead is to Stone in proportion, as	4 to 1
Iron to Braſs is	16 to 15
Iron to Stone bears your Proportion, as	3 to 1

Example. A ſhot of 2 lb.wt. of Iron, is of like Diameter or Height, as a ſhot of 3 lb.wt of Lead. So a ſhot of 30 lb.wt. of Stone, is as big as a ſhot of Iron of 80 lb.wt. ſo of the reſt.

PROBLEM XI.

The Weight of one Piece of Ordnance of Braſs given, to find the Weight of another Piece of Braſs thereby.

Example. Suppoſe a Braſs Saker be 19 C.wt. at the greateſt thickneſs is 11 Inches and ½, the Weight is required of a Braſs Piece that is 8 inches and ½.

The Logerithm of the greateſt Diameter.		306069
	11, 50	
	100	
Logerithm of the leſſer Diameter.	8,75	294210
	the Difference,	011859
	The Tripple of Difference.	035577
The Tripple Difference added to the Log. of the leſſer Diameter.		
	The tripple Difference Subſtracted, *&c.*	027835
	weight required 837 lb.wt.	292224

PROBLEM XII.

To Renew and make Gunpowder good that hath loſt its Strength.

Example. Moiſten it with Vinegar or Water, beat it in a Mortar; then ſift it thro' a fine Sieve, to every Pound add one Ounce of Salt-Peter then Beat and Moiſten this Mixture again; and if you ſee by breaking or cutting with a Knife, no ſign of Salt-Peter or Brimſtone in it, Corn it, and you have done.

PROBLEM XIII.

How to Preſerve Powder from Decaying.

Example. Turn your Barrels often, and Catridges upſide down, that the Saltpeter may

may diſperſe it ſelf, for your Powder by lying long, the Salt-Peter ſettle downward, and weakens the upper part of the Powder, and makes the other part ſtronger; in this caſe often turning is the only Remedy.

PROBLEM XIV.

How to know the length of the Breechings and Tackles for any piece.

Example. For great Guns. For every Foot of the length of your Gun, allow one Fathom for the Tackle; for ſmaller Guns, 4 times the length of the Gun, the Breeching 3 times the length of the piece: If a piece of Ordnance break looſe at Sea, diſmount it, or elſe it will diſmount it ſelf, than choke it up to ſtow it.

PROBLEM XV.

How to make Hand Granadoes.

Example. On your Granado ſhell faſten one Paper, and faſten Lead and ¼ Shot, and Pitch it over, when it is dry fill it with Powder and ſtop it up. *Note*, When you uſe it, be ſure you caſt it from you as ſoon as the Fuſſee is Fired; obſerve to 1 Pound of Powder, add 6 Ounces of Salt Peter, and one Ounce of Charcoal, which are good mixtures your Fuſſee, wrought with Brandy or Spirits.

PROBLEM XVI.

How to make Powder Cheſts.

Example. Make them with 4 Boards, lay them ſhelving within, and fill them with Stones and Old Iron, put in your Powder, and when you have occaſion ſet Fire to it, with a Fuſſee or Piſtol where it is placed.

PROBLEM XVII.

How to make Powder Pots.

Example. They are made of Earth, with Ears to tye light Matches to; theſe filled with Powder, mixt with Brimſtone, beaten fine, ſome *Aſſa Fœtida*, ſome pieces of Verdigreeſe and Camphire. Theſe Pots are offenſive and of good uſe.

PROBLEM XVIII.

How to make an Excellent Match for Service.

Example. Hemp not very fine, or Tow which will Conſume ſooner, but yet better, twiſt

twiſt them in their Proportions, according to the bigneſs you will have your Match; Boyl them in ſtrong Aſhes, and a little *Salt Peter*, untill all the Lye be waſted, and then make it up and dry it, making it ſmooth, and keep it for ſpecial uſe. Such Match will not deceive you in bad Weather.

PROBLEM XIX.

How to make Fire Arrows or Darts.

Example. Make your heads of Iron, ſharp and bearded, that they may ſtick faſt when they light, with a long ſhaft of Wood, and about the middle of the head make faſt a Linnen bag, in form of an Egg, leaving open at the end a hole to fill it with the Compoſition; take one Pound of Peter, half a Pound of Gunpowder, as much Brimſtone in Powder, theſe mixed, and well mingled with Oyl of Petiol, with this fill the bag about the head of the Arrow, and bind it about with Wier. For your Priming, dip Cotton wick into Gunpowder wet with Water and well dryed, than it is fit for uſe; let your ſhafts be ſo faſtened, as when they ſtick any where, that whoſoever endeavour to put them out, may leave the heads to burn. Theſe Arrows when well Shot, will Annoy the Enemy very much.

PROBLEM XX.

How to make a Shot at the Enemy by Day, or to his Light by Night.

Example. This chiefly concerns the uſe of this Art in *Sea Service*, motion making it differ at *Sea* from the Land. Here when you diſpart your piece, which muſt be done with a quick motion, obſerving the motion of the Ship, and ſtreng h of the Wind, all which, duly obſerved, and according to the Momen: of time, Command to Fire; in good Weather, a regard always muſt be had that you do not Drown your Shot, that is, when your motion and diſpart happen at Fireing to be below your Mark aimed at, forbear Fireing when you are at a diſtance, in this Nature to the Body, but let your Fireing be at random, when you draw nearer, than let your Firing be to the Body. This by day.

By Night diſpart your piece with a light Match on the Muzzle, when you Fire againſt any light, bringing the middle of the Baſe Ring, and the Match and the Enemies light together, then give Fire. *Note*, This Noble Art came in ſoon after the Invention of Gunpowder, by *Bartholdus*, a *Monk*, in the year 1370. he Accidently let fall a ſpark of fire upon Brimſtone and Salt Peter beaten to Powder, in a Mortar covered with a *Slate Stone*, and ſeeing this mixture, blew up the Stone from the Mortar, deviſed a kind of Powder, taught the *Venetians* to uſe it in Pipes of Iron againſt the *Genoves*. The *Italians* gives the firſt Inventer of Gunpowder to *Archimedes*. Travellers ſays, That the People of *Chiney*, had the uſe of Guns and Gunpowder long before, and, that the making and uſe was brought into *Europe* from thence by a *Monk*.

PROBLEM XXI.

How to prepare Powder Barrels at the Yard-Arms.

Example. A Rope Reeved in a Block at the Main yard-Arm, and brought into your cloſe

cloſe Quarters, and your Cask prepared with a Fuſſee, as a Powder Cheſt, putting into it your Combuſtable matter, as pieces of Iron, Old Nailes, with Stones and Croſs-Bars of Iron; Thwart the Cask with 10 or 15 Pound of Powder in it, place your Cask as you can to fire your *Fuſſee*, and hoiſt it from your ſide in your Cloſe Quarters, ſo as to let it fall on the Enemies Deck, from the *Fore* and Main Chains; place it ſo as the *Fuſſee* may be Fired with a Linſtock, by juſt opening your Port and give Fire; your Barrel or Casks of 10 or 20 Gallons made ſlightly faſt, will break off from your ſide by pulling on your Rope in your Cloſe Quarter, than let it fall on the Enemies Deck, and it will Damage him at that rate, as to cauſe him to ſheer off, the ſame you may do from your Crojack-yard or Fore-yard.

PROBLEM XXII.

Here followeth Directions neceſſary for Sea-Gunners.

At your firſt Entrance into the Ship, look to the Nature of your Guns, and how they are Fortified, Reinforc'd or Leſſen'd in Mettle, than let him clean all his Guns, and ſearch them, to know what are Taper Board, and what have Flaws, Cracks, or Hony Combs, than find your Shot and the weight, and where your Guns are of different Natures; mark your Carriage over the Port Catridge and Port, with a known mark for that Gun; to prevent miſtake, it is beſt, when your Guns are all of one bore, and they ought to be ſo in ſmall Ships, than pour half a Pound of fine Powder into the Touch hole or leſs, and blow them off, than ſponge them well, and finding them clear, Load them with their reſpective Cartridges of Powder made for their Charge, Ram your Cartridge well home with a ſtraight wad after it, than put in your Ball, that ought to rowl home to the wad, than ſet in a wad cloſe home to the Shot to keep it from rowling out of the piece, than Tompkin your Gun and make it tight, and ſtop your Vent with Okum, put on your Apron, ſo faſten your piece. When your Guns are all Laden, you ought to be provided with 20 Rounds of Catridges in a Merchant Man, 10 Rounds filled and 10 empty. Be ſure to be careful at all times when you are buſie with your Powder in any manner whatſoever, that there be no ſort of Fire near you, than ſort your Powder in the Cartridges and Shot, ſo for your Guns, that they may go directly to their Gun. Be careful of Guarding your Powder Room, with covering your Powder with Skin or the like; mind alſo to turn your Powder every Month; mind your Tallow, or Soap, your Axletree well, and let your Rope, Rammers, and Spunges be ready at hand; likewiſe, be mindful you draw your Guns every Month, and try them after bad Weather, by taking out their Tompkins, and you will ſee if any Water hath come to the Powder, if ſo, than unlade them and blow them off, ſo Lade again. Above all, he ought to be careful of Fire in any part of the Ship where his Powder is, as well as the Powder Room.

PROBLEM XXIII.

What neceſſaries belong to the Ordinance of a Ship required by the Gunner.

I ſhall not mention the quantity, be it for a Man of War or a Merchant Man, ſo I'll leave that to the diſcretion of each Gunner, according to the force their Ship is of, ſo I ſhall only give their Names. *Example.*

Example. Powder, Round ſhot of ſeveral ſorts, double headed in their ſorts, Cart Iron of a Foot and a half in length, Handſpike, Rammer heads, and Worms, Wooden Tompkins in ſorts, Cartridge, Paper, Thread and Needles, Twine, *Starch* and Match, Mallets, Ladles, Spunge heads, with Staves; Tackles, Laſhers, double and ſingle Blocks, Beds and Coynes, Old Shrouds for Breeching, and twice laid ſtuffs for Tackles, New Rope for double Tackles, ſome Old Shrouds for Spunges, ſome Line, Marling, Tarr, Twine Moulds for Cartridges, Port Ropes, Axletrees and Trucks, and Spindles, Crow, Splice Irons, Budge Barrels, *Primers*, Rings and Staples, Tackle Hooks, Nails, Thimbles, *Port* Bands, Musket and *Piſtol* ſhot, *Sheet* Lead, *Scales* and Weights, *Powder* Meaſures, *Powder* Horns and *Priming* Irons, *Soap*, a pair of Nippers, *Pliers*, a Hand Vice, ſhot Mould for Lead, a Drill.

PROBLEM XXIV.

How to loſen a Shot that ſticketh faſt in a piece, and a Nail in the Vent.

Example. A ſhot ſticking faſt in a piece, or if by lying long be faſt by Ruſt, get the Salt Peter from your *Powder* by Water or Vinegar, than with dry *Powder* blow out your piece, and in 2 or 3 times your ſhot will out, and no damage; if a piece of Iron be in the Vent *Power*, pour Oyl in it, and if you have time, it will come out ſafe, or uſe your Drill, *Spirit* of Vitorel, or Aquafortis.

A Table ſhewing how to find the Weight of any Shot from 1 Inch $\frac{11}{100}$ Parts of an Inch Diameter, to 8 Inches $\frac{11}{100}$ Parts of an Inch Diameter.

Dia. I. P.	Wt. lb. ʒ.	Dia. I. P.	Wt. lb. ʒ.	Dia. I. P.	Wt. lb. ʒ.	Dia. I. P.	Wt. lb ʒ.	Dia. I. P	Wt. lb. ʒ.	Dia. I. P.	Wt. lb. ʒ.
1 53	0 50	4 40	12 0	5 84	28 0	6 79	44 0	7 53	60 0	8 25	79 0
1 75	0 75	4 52	13 0	5 91	29 0	6 84	45 0	7 57	61 0	8 29	80 0
1 92	1 0	4 63	14 0	5 98	30 0	6 89	46 0	7 61	62 0	8 32	81 0
2 20	1 50	4 74	15 0	6 4	31 0	6 94	47 0	7 65	63 0	8 35	82 0
2 42	2 0	4 85	16 0	6 11	32 0	6 99	48 0	7 69	64 0	8 39	83 0
2 61	2 50	4 95	17 0	6 17	33 0	7 4	49 0	7 73	65 0	8 43	84 0
2 77	3 0	5 4	18 0	6 23	34 0	7 8	50 0	7 77	66 0	8 46	85 0
2 92	3 50	5 13	19 0	6 29	35 0	7 13	51 0	7 81	67 0	8 49	86 0
3 5	4 0	5 22	20 0	6 35	36 0	7 18	52 0	7 85	68 0	8 52	87 0
3 29	5 0	5 31	21 0	6 41	37 0	7 22	53 0	7 89	69 0	8 55	88 0
3 43	6 0	5 39	22 0	6 47	38 0	7 27	54 0	7 93	70 0	8 59	89 0
3 63	7 0	5 47	23 0	6 52	39 0	7 31	55 0	7 96	71 0	8 62	90 0
3 85	8 0	5 55	24 0	6 58	40 0	7 39	56 0	8 0	72 0	8 65	91 0
4 0	9 0	5 62	25 0	6 63	41 0	7 40	57 0	8 4	73 0	8 68	92 0
4 14	10 0	5 70	26 0	6 68	42 0	7 44	58 0	8 7	74 0	8 71	93 0
4 28	11 0	5 77	27 0	6 74	43 0	7 49	59 0	8 11	75 0	8 74	94 0
								8 15	76 0	8 79	95 0
								8 18	77 0	8 81	96 0
								8 22	78 0	8 84	97 0
										8 87	98 0
										8 90	99 0
										9 93	100 0

A Table ſhewing the Weight Diameter, the heihgt of the Shot, the Weight of Powder for Proof and for Service; the paces they ſhoot at Point Blank and at Random by every Reſpective piece of Ordnance mentioned.

W C.	Names.	Diam.	Diam. ſhot.	Wt. ſhot.	Powd. for Proofe.	Powd. for Service.	Poin Blank.	Pace atRo
70	Cannon 8	8 0	7 75	63 0	28 0	23 0	1800	1800
60	Cannon 7	7 0	6 75	42 0	24 0	18 0	1800	1800
50	Demi-Can.	6 0	6 5	32 0	20 0	15 0	1800	1800
40	Culverin	5 87	5 62	24 0	17 0	14 0	1800	1840
35	Demi-Culv.	4 16	4 64	12 0	10 5	8 5	1840	1740
20	Saker	3 58	3 40	5 25	5 25	4 0	1650	1660
12	Minion	3 35	3 18	4 0	4 0	3 0	1200	1200
5	Faulcon	2 26	2 54	2 5	2 5	1 0	1200	1200

Note, There is a Proportion which is the Weight of the *Shot* in Powder, for to prove the piece, and $\frac{1}{3}$ of the Weight of the *Shots* for *Service*.

The Explanation and Uſe of the Table of Squares.

Example. It is required to find the *Square* of 135 Foot 10 Inches, look into the Table of *Squares*, and on the top you will find *F. I.* ſignifies Feet and Inches, until you find 135 Foot and 10 Inches, and on the right hand in the next Column ſtands 2656900, the *Squares* required,

How to find the Square Root of any Number contained in this Table.

Example. It is required to find the *Square* Root of 2656900, apply to the Table of *Squares*, and ſeek for this number, and right againſt it in the Table of *Squares* on the left hand *Page*, is 153 Foot and 11 Inches the *Square* you ſought; this ſaves you the trouble of Extracting the Root.

How to make the Table of Squares.

Example. The *Square* of 25 Foot, is required in Inches, bring your Feet into Inches, and *Square* your product, you have your deſire;

25 Foot,
12 Inches.

50
25

300
300 Multiply;
90000 *Squared*, look in the Table for the *Square* 90000, and you find 25 the Root.

Example. The *Square* of 85 Foot 9 Inches is required,

85 Foot 9 Inches.
12

179
85

1029
1029

9261
2058
0000
1029

1058841 At 85 Foot 9 Inches in the Table of *Squares*.

This *Square* Number is ſet, the whole Table being produced in this manner, which ſheweth the *Squares* and Roots from 1 Inch to 3180 Inches.